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INSTRUCTION MANUAL

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NOISE AND FIELD
INTENSITY METER

MODEL NF-112-F

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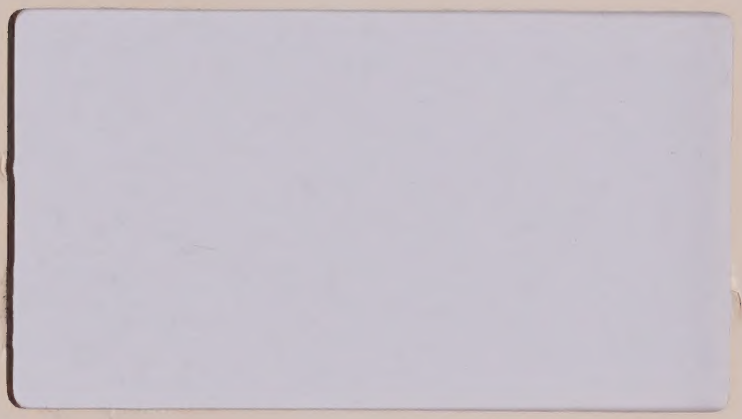

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EMPIRE*

NOISE AND FIELD INTENSITY METER

MODEL NF-112-F

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1. Model or Type
2. Serial Number
3. Description of trouble(2)
4. Test instruments used
5. Approximate date instrument was placed in operation
6. Approximate number of hours of use
7. Has maintenance action been previously requested?
8. Other comments

Upon receipt of this information our Service Department will send you service data or shipping instructions. Upon receipt of shipping instructions forward the instrument to the factory prepaid. If requested, an estimate of charges will be made before work begins.

(1) Contact Metrics Division, Bridgeport, Connecticut for *Commander**, *Empire**, *Panoramic**, and *Sensitive Research** instruments. Contact Metrics Division, Los Angeles, California for *Gertsch** instruments.

(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.

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INSTRUCTION MANUAL

*EMPIRE**

NOISE AND FIELD INTENSITY METER

MODEL NF-112

Serial No. _____

Instruction Manual No. 110-5079

SINGER INSTRUMENTATION

Precision electrical and electronic instruments for measurement

emc — EMPIRE* — Gertsch* — Panoramic* — Sensitive Research*

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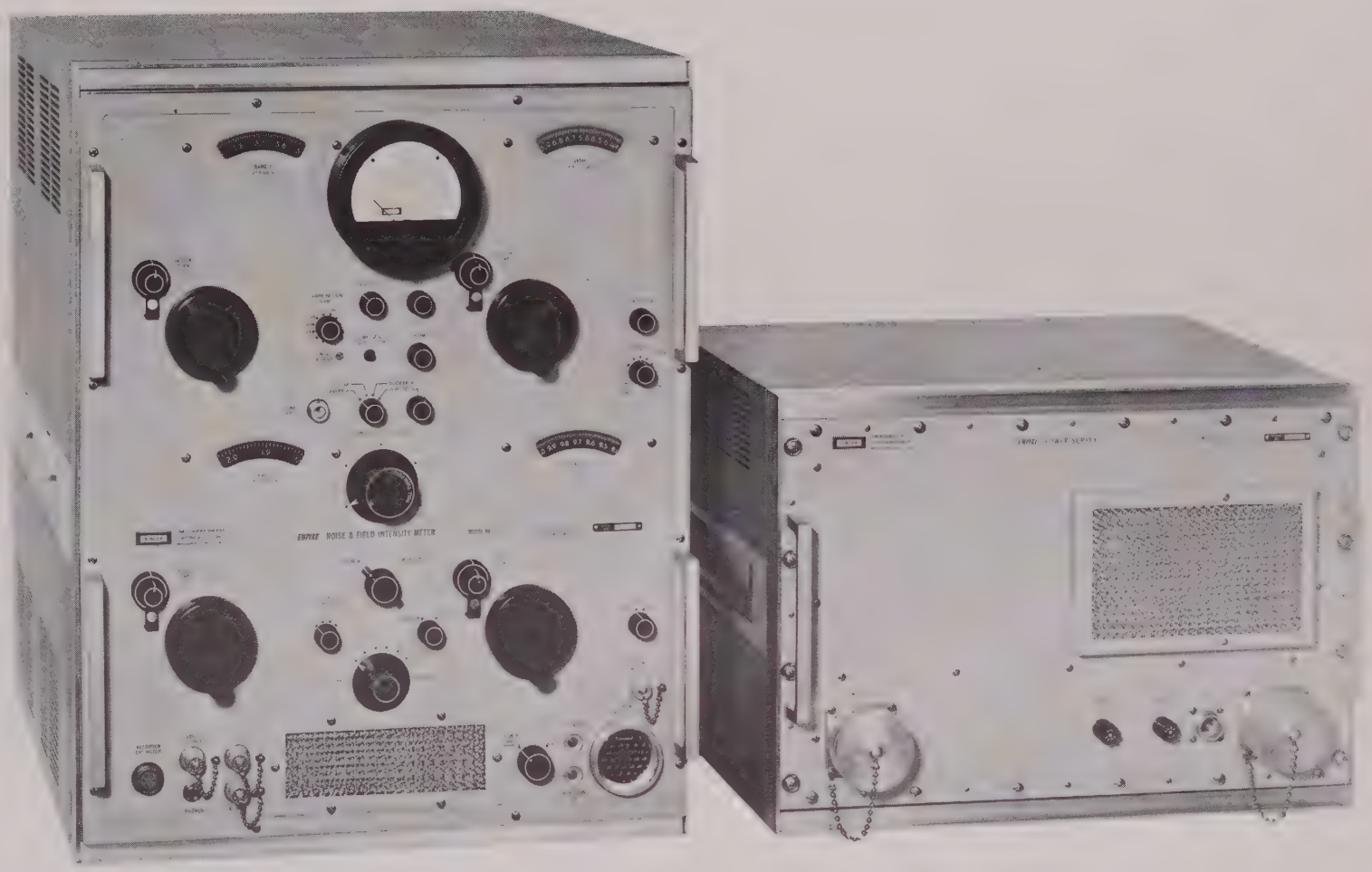

Figure 1-1. Noise and Field Intensity Meter System, Model NF-112-F

SECTION 1

GENERAL INFORMATION

1-1. GENERAL.

1-2. This Instruction Manual describes the electrical and physical characteristics, applications, installation, and operation of the EMPIRE* Model NF-112-F Noise and Field Intensity Meter System (See Figure 1-1). Accessories, designed for use with the Model NF-112-F and additional equipment, required for special applications, although not supplied with the Model NF-112-F, are also included.

1-3. The major items described in this Instruction Manual are as follows:

a. Model NF-112-F Main Unit

b. Model PS-112-F Power Supply

c. Model TM-112-F Tuning Module

d. Model KT-112 Standard Accessory Kit

e. Model KT-112-5 Antenna Kit

f. Model KT-112-6 Antenna Kit

g. Model BB-112 Broadband Antenna Set

1-4. The Model NF-112-F Main Unit and the Model PS-112-F Power Supply are used for measurements in the 1 to 10 Gc/s frequency range. The addition of the Model TM-112-F Tuning Module to the system, extends the frequency range to 22 Gc/s. The Model KT-112 Standard Accessory Kit contains items necessary for the operation of the instrument. It also contains the Model AT-112 parabolic reflector and antennas covering the frequency range of 1 to 10 Gc/s. The Model KT-112-5 and Model KT-112-6 Antenna Kits operate with the Tuning Module Model TM-112-F. The Model BB-112 Broadband Antenna Set furnishes an omnidirectional antenna, useful for rapid spectrum surveillance of the 1 to 10 Gc/s frequency range.

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1-5. All of the above items are required for full operation of the Model NF-112-F Noise and Field Intensity Meter System, and are included throughout this Instruction Manual. Additional items, required for special applications and readout purposes, are included in ACCESSORIES, paragraph 1-36.

CAUTION

Do not attempt to operate the equipment until thoroughly familiar with the procedures detailed in Section 3 (OPERATION). Incorrect operation may result in malfunction or damage to the Model NF-112-F and its associated equipment.

1-6. DESCRIPTION.

1-7. The Model NF-112-F Noise and Field Intensity Meter System comprises a triple conversion, superheterodyne receiver used for measuring the intensity of electromagnetic energy in the radio frequency range between 1 and 22 Gc/s. The measurements may be two terminal (conducted) or radiated, and may be made on narrow band or broadband signals.

1-8. MODEL NF-112-F MAIN UNIT. The Model NF-112-F Main Unit consists of four RF Tuning Units (T-1 through T-4) and all common measuring circuitry. The Tuning Units each cover a portion of the Main Unit's 1 to 10 Gc/s frequency range, and accomplish the initial RF conversion. The purpose of the Main Unit is to measure and display the strength of the RF tuned to by the selected Tuning Unit.

1-9. Associated with each Tuning Unit are all circuits unique to their respective frequency range. These include: a linear tuning mechanism; double preselector cavities; an RF mixer; a klystron local oscillator; and RF filters. A choice of automatic frequency control (AFC) of the klystron local oscillator is available, as well as a choice of manual or motor drive tuning.

1-10. The Tuning Units feature a unique and reliable tuning mechanism which insures accurate tracking of the preselector and klystron cavities over their wide frequency range; thus, insuring optimum sensitivity and spurious response rejection characteristics. The

double preselector cavities preceding the RF mixer, greatly reduce the possibility of pulse overload and cross modulation.

1-11. The two major outputs of each Tuning Unit are the first intermediate frequency (IF) and the X coordinate for X-Y plotting. The first IF, 348 Mc/s; is coupled to the Main Unit common measuring circuitry for further conversion. The X coordinate information is a DC voltage varying in amplitude from 0 to 10 volts as a linear function of frequency. This information is coupled through the Main Unit and is supplied as the X coordinate for the X-Y plotting output.

1-12. The Tuning Units may be motor drive tuned,over their entire frequency range or over a predetermined sector,at an adjustable rate. Individual sector scan controls, associated with each Tuning Unit, set the high and low frequency limits. Controls associated with the Main Unit determine the mode of operation (full range scan, manual, or sector scan) and the relative scan rate.

1-13. Selection of each of the Tuning Units for operation is accomplished through use of a single selector switch on the Main Unit.

1-14. The Main Unit accepts the incoming signal from the RF input cable or pickup antenna, selects one of the Tuning Units for operation, controls the amplitude of the RF signal supplied to the Tuning Unit, converts the signal to 348 Mc/s IF,then to 60 Mc/s, and finally to 42 Mc/s. The 42 Mc/s IF signal is detected and displayed on the front panel meter. Audio monitoring is provided by an internal speaker or external earphones.

1-15. The Main Unit also supplies the following outputs: a pre IF output of 60 Mc/s and a post IF output of 42 Mc/s for spectrum signature analysis; a video output with a pulse stretching feature for oscilloscope display; a phones jack output for aural monitoring; an amplitude information output for a remote meter indication, duplicating that of the front panel meter; and an X coordinate output varying as a linear function of frequency, and a Y coordinate output varying as a function of incoming signal strength, both required for X-Y plotting.

1-16. The principal circuits which are common to the system are: RF and IF attenuators; an impulse generator; a motor driven band selector switch; a scanner chassis for controlling the rate and mode of each Tuning Unit scanning mechanism; a 348 Mc/s IF post amplifier; a local oscillator; a 60 Mc/s IF mixer preamplifier; a 60 Mc/s IF amplifier; a 42 Mc/s IF and video amplifier; video pulse stretching circuitry;

IF bandwidth circuitry; IF output filters; automatic frequency control circuitry for locking on to the incoming signal; an indicating meter and metering circuitry; an audio amplifier and monitoring circuitry, including an internal speaker; an internal blower; and power distribution circuitry.

1-17. Dual bandwidths of 600 Kc/s and 3 Mc/s enable the operator to identify the unknown incoming signal as narrow band or broadband by noting the difference in indicated output as the bandwidth is changed.

1-18. The impulse generator is used for fast and accurate calibration (referred to the RMS value of an unmodulated sinewave) of both CW and broadband noise. Average or peak measurements of CW signals are made by means of the visual indicating meter which indicates intensity in both microvolts and DB above one microvolt. A peak indication of broadband signals is achieved by directly reading the indicating meter (true peak VTVM) or by the aural slideback method.

1-19. Calibrated pickup devices are available which permit the determination of field strength of narrow band signals in terms of microvolts per meter and that of broadband signals in terms of microvolts per megacycle per meter.

1-20. The instrument is designed for permanent installation, such as in a mobile van or aircraft, for applications requiring a rapid scanning of a wide frequency spectrum, and for uses that cannot tolerate even a short warmup period.

1-21. The Main Unit is enclosed in an electrostatically shielded dust cover and cooled by a forced air blower. The instrument may be used without further enclosure, mounted in an optional cabinet, or installed in the user's standard 19 inch relay rack, without impairing shielding effectiveness.

1-22. All Tuning Units and major circuits of the Main Unit are supplied with heater voltages during instrument operation. Thus, no warmup delays are encountered when Tuning Units are switched in order to cover the entire spectrum.

1-23. MODEL PS-112-F POWER SUPPLY. The Model PS-112-F Power Supply is an individual item necessary for the operation of the Main Unit and the Tuning Module. The Model PS-112-F supplies all plate, filament, and control voltages required for the operation of both units.

1-24. Special features of the Power Supply include: AC line filtering and fusing; transistorized low level regulated DC voltage circuitry;

forced air cooling; and extensive shielding and filtering.

1-25. Full plate and filament voltage supply regulation is provided in order to maintain a calibration accuracy within ±1 DB over an input line voltage range of 105 to 125 VAC.

1-26. Control of the Power Supply is accomplished through use of the Main Unit front panel POWER Selector Switch. Two modes of operation are available; STANDBY and KLYSTRON ON. When first switched from OFF to STANDBY, all of the Power Supply circuits become activated, except for the klystron beam power. When switched directly from OFF to KLYSTRON ON, a 45 second delay is encountered before klystron beam power is applied. Thereafter, there is no delay. The selected mode of operation is indicated by the Main Unit front panel STANDBY and KLYSTRON ON Indicators.

1-27. Packaging of the Power Supply is similar to the Main Unit. The main chassis is enclosed in an electrostatically shielded dust cover and is cooled by a forced air blower. The Power Supply may be used without further enclosure, mounted in an optional cabinet, or installed in the user's standard 19 inch relay rack, without impairing shielding effectiveness.

1-28. MODEL TM-112-F TUNING MODULE. The Model TM-112-F Tuning Module serves as a range extension unit for the Main Unit, allowing measurements up to 22 Gc/s. The Tuning Module consists of two waveguide RF Tuning Units (T-5 and T-6), which cover the frequency ranges of 10 to 15 Gc/s and 15 to 22 Gc/s, respectively. Both waveguide Tuning Units have a separate waveguide input, an associated waveguide input attenuator, individual scanning mechanisms, and scan rate controls.

1-29. The incoming signal is directly coupled to the applicable waveguide Tuning Unit where the appropriate attenuation is inserted, and the initial conversion is accomplished. The 348 Mc/s IF output from the Tuning Module is coupled through an external IF cable to the Main Unit where it is further detected and displayed in the same manner as the Tuning Unit T-1 through T-4 348 Mc/s IF outputs.

1-30. The Tuning Module is enclosed in an electrostatically shielded dust cover, and may be used without further enclosure, mounted in an optional cabinet, or installed in the user's standard 19 inch relay rack, without impairing shielding effectiveness. Also, all major circuits are supplied with heater voltages during instrument operation, alleviating warmup delays when Tuning Units are switched.

1-31. Selection of waveguide Tuning Unit T-5 or T-6 for operation is accomplished through use of the same Main Unit selector switch used for selecting Tuning Units T-1 through T-4.

1-32. APPLICATIONS.

1-33. The Model NF-112-F Main Unit and its associated equipment combine to form a noise and field intensity measuring system which, because of its high degree of sensitivity, broad frequency range, and overall versatility, lends itself to a multitude of applications. Some of these applications are listed below.

a. Measuring two terminal RF voltages.

b. Measuring field strengths.

c. Localizing the source of RF energy.

d. Studying communication conditions at a given site, by recording atmospheric noise versus time.

e. Studying fading effects of RF signals, by recording signal strength versus time.

f. Determining the usefulness of a site for RF transmission and reception.

g. Determining the area of useful transmitter coverage.

h. Determining shielding effectiveness.

i. Determining the polarization of a radiated wave.

j. Determining the effectiveness of RF suppression measures on sources of RF interference.

k. Determining the effects of electromagnetic environment upon electronic equipment, in terms of degradation and failure as the intensity of the electronic environment becomes more severe.

l. Measuring the strength of RF interference voltage present in electrical interconnecting, control, and power distribution leads.

m. Measuring the power versus frequency distribution of a transmitter output. (A transmitter output emission spectrum includes the fundamental frequency and associated modulation sidebands, as well as harmonic and non-harmonic spurious emissions and their associated sidebands. Spurious emissions include harmonics, parasitic emissions, and intermodulation products.)

n. Measuring spurious radiation.

o. Measuring ambient RF interference.

p. Measuring receiver local oscillator radiation.

q. Measuring relative polarization angles.

r. Measuring the intensity of pulses which are sporadic or which occur at low repetition rates.

s. Evaluating interference interaction of electronic components and systems.

t. Monitoring radiation from electronic equipment by production quality control.

u. Monitoring radiation from electronic equipment after maintenance.

v. Antenna radiation pattern analysis.

w. Analyzing bandpass, band rejection, and discriminating characteristics of electronic components, circuitry, and systems.

x. Analyzing reflection and absorption characteristics of materials surrounding a source of electromagnetic energy.

y. Tuning electronic circuits, by using the instrument as a tunable high sensitivity null detector.

1-34. EQUIPMENT SPECIFICATIONS.

1-35. The electrical and physical characteristics and specifications of the Model NF-112-F Noise and Field Intensity Meter System are listed in Table 1-1. Characteristics of the accessory pickup devices and additional equipment are described in paragraph 1-36.

TABLE 1 - 1. EQUIPMENT SPECIFICATIONS.

PICKUP DEVICES	(Refer to paragraph 1-36 for a detailed explanation of Pickup Device accessories.)
LPA-112	Calibrated Log Periodic Antenna used for 1 to 10 Gc/s frequency range (mounts on AT-112 Parabolic Reflector).
HF-112	Calibrated Horn Feed used for highest gain in 6 to 10 Gc/s frequency range (mounts on At-112 Parabolic Reflector).
BB-112	Omni-Directional Broadband Antenna used for spectrum surveillance of entire 1 to 10 Gc/s frequency range.
CB-112	Input Cable (RF coaxial, type N) used for all direct reading two-terminal RF voltmeter measurements, and coupling to pickup antenna.
HF-112-5	Calibrated Horn Feed (mounts on AT-112 Parabolic Reflector) used for 10 to 15 Gc/s frequency range.
LGA-112-6A	Calibrated Low Gain Antenna (mounts on AT-112 Parabolic Reflector) used for 15 to 22 Gc/s frequency range.
HGA-112-6B	Calibrated High Gain Antenna and attached Parabolic Reflector used for 15 to 22 Gc/s frequency range.
INPUT CONNECTORS:	
NF-112-F	Type N female.
TM-112-F (Tuning Units T-5 and T-6)	Flange type connectors mate to Flexible Waveguide FW-112-5 (type WR-75) for T-5, and to Flexible Waveguide FW-112-6 (type WR-51) for T-6.
INPUT VSWR	Less than 1.5 to 1.
INPUT IMPEDANCE	50 ohms nominal.

TABLE 1 - 1 EQUIPMENT SPECIFICATIONS (Cont).

INPUT ATTENUATION:	
NF-112-F	0 to 80 DB in 20 DB steps through use of SIGNAL INPUT ATTEN (DB) Coaxial Step Attenuator Selector Switch.
TM-112-F	0 to 60 DB in 20 DB steps for Tuning Units T-5 and T-6 through use of Attenuator/Calibrate Waveguide Step Attenuator Selector Switch; an additional 20 DB is automatically added in the NF-112-F IF circuitry when the SIGNAL INPUT ATTEN(DB) Selector Switch is positioned to any range other than 0 DB.
EXTERNAL	A variety of EMPIRE Fixed or Step, Coaxial or Waveguide, Broadband Microwave Frequency Attenuators may be used to externally extend the dynamic range of measurement. (Refer to paragraph 1-36.)
FREQUENCY RANGE:	The Main Unit covers the entire frequency range from 1 to 10 Gc/s in a single instrument by means of four Tuning Units with overlapping frequency bands; the Tuning Module contains two Tuning Units which extend the Main Unit range of measurement to 22 Gc/s.
NF-112-F	0.9 to 10.2 Gc/s (Four Tuning Units)
T-1/NF-112-F (Band 1)	0.9 to 2.1 Gc/s
T-2/NF-112-F (Band 2)	2 to 4 Gc/s
T-3/NF-112-F (Band 3)	3.9 to 7.1 Gc/s
T-4/NF-112-F (Band 4)	7 to 10.2 Gc/s
TM-112-F	10 to 22 Gc/s (Two Tuning Units)
T-5/NF-112-F (Band 5)	10 to 15 Gc/s
T-6/NF-112-F (Band 6)	15 to 22 Gc/s
NF-112-F and TM-112-F	0.9 to 22 Gc/s (Six Tuning Units)
FREQUENCY BAND SELECTION	The BAND SELECTOR Switch selects one of the six Tuning Unit frequency bands.

TABLE 1 - 1 EQUIPMENT SPECIFICATIONS (Cont).

FREQUENCY TUNING:	FULL SCAN, MANUAL, or SECTOR SCAN tuning modes are selectable through use of Scan Mode Selector Switch.
FULL SCAN MODE	(a) Operate position (OPR) allows a single sweep of the entire frequency range of each Tuning Unit, from the low frequency end to the high frequency end, at an adjustable rate from approximately 2 Mc/s per second, minimum, to approximately 10 Mc/s per second, maximum. (b) Return position (RET) returns each Tuning Unit to its low frequency end at maximum speed.
MANUAL SCAN MODE	Allows the Tuning Control of each Tuning Unit to be manually operated.
SECTOR SCAN MODE	Allows the continuous sweeping of each Tuning Unit over a predetermined sector. The width of the sector scanned is adjustable from any 5 degrees of dial rotation, minimum, to the entire range of dial rotation, maximum.
FREQUENCY CALIBRATION ACCURACY	Within 1% of dial reading for each Tuning Unit.
BANDWIDTH:	Dual bandwidths, selectable through use of Bandwidth Selector Switch.
WIDE BAND	3 Mc/s bandwidth.
NARROW BAND	600 Kc/s bandwidth.
EFFECTIVE IMPULSE BANDWIDTH RATIO	A nominal difference of 5 to 1 or 14 DB between wide and narrow bandwidths.
AUTOMATIC FREQUENCY CONTROL (AFC)	Locks on to any frequency, within the entire range of the six bands, to which the instrument is tuned to; operates for both wide and and narrow bandwidths; may be turned off through use of AFC ON/OFF Selector Switch.

TABLE 1 - 1 EQUIPMENT SPECIFICATIONS (Cont).

RECEIVER TYPE	Triple Conversion Superhetrodyne.
INTERMEDIATE FREQUENCIES (IF)	348, 60, and 42 Mc/s .
SPURIOUS RESPONSE REJECTION	Greater than 60 DB for image frequency. Greater than 80 DB for all other frequencies.
LOCAL OSCILLATOR RADIATION	Less than 100 microvolts.
SHIELDING EFFECIVENESS	Better than 96 DB.
IMPULSE GENERATOR:	A Broadband Impulse Noise Generator, built into the Main Unit, provides a standard for calibration.
PULSE POLARITY	Automatically reverses polarity at approximately 55 cycles per second.
PULSE REPETITION RATE	Approximately 400 cycles per second.
TWO-TERMINAL SENSITIVITY:	The minimum discernable signal (MDS) for wideband and narrow band operation is as follows:
TUNING UNITS	
T-1/NF-112-F	-97 and -104 DBM or 1.4 and 3.0 μv
T-2/NF-112-F	-97 and -104 DBM or 1.4 and 3.0 μv
T-3/NF-112-F	-94 and - 97 DBM or 3.0 and 4.4 μv
T-4/NF-112-F	-94 and - 97 DBM or 3.0 and 4.4 μv
T-5/NF-112-F	-90 DBM or 7.0 μv (50 Ω)
T-6/NF-112-F	-90 DBM or 7.0 μv (50 Ω)
TWO-TERMINAL RF VOLTMETER RANGE:	
CARRIER INTENSITY MEASUREMENTS	10.0 microvolts to 1.0 volt.
NOISE MEASUREMENTS	$\frac{10}{\text{Bandwidth (MC)}}$ μv/MC to $\frac{1.0}{\text{Bandwidth(MC)}}$ volts/MC

TABLE 1 - 1 EQUIPMENT SPECIFICATIONS (Cont).

TWO-TERMINAL RF VOLTMETER ACCURACY	±1.5 DB full scale.
MEASUREMENT METHODS	AVERAGE, PEAK, or SLIDEBACK, selected through use of Meter Function Selector Switch.
CW MEASUREMENTS (NARROW BAND)	(a) Average indication of unmodulated carriers. (b) Average indication of modulated carriers. (c) Peak indication of unmodulated carriers. (d) Peak indication of modulated carriers.
BROADBAND MEASUREMENTS	(a) True peak reading meter. (b) Aural slideback.
INDICATING METER	4-1/2 inch logarithmic movement calibrated in microvolts (5 to 100) and in decibels (+14 to +40); a Remote Indicator, RE-112-X, duplicating the Main Unit front panel Indicating Meter, is available as an accessory.
RECORDER-EXTERNAL METER OUTPUT	100 microamperes at 1800 ohms DC; permits simultaneous remote metering or external recording without disabling the Main Unit Indicating Meter.
X-Y PLOTTING:	Provision for an X-Y plotting output is built-in.
X COORDINATE OUTPUT	A DC voltage varying from 0 to 10 volts is supplied as a function of frequency.
Y COORDINATE OUTPUT	The Y coordinate (amplitude information) is same as the Recorder-External Meter Output.
IF OUTPUTS:	Both pre and post IF outputs are provided for spectrum signature analysis; the Spectrum Signature Analyzer, Model PA-210 is available as an accessory. (Refer to paragraph 1-36.)
PRE IF OUTPUT	60 Mc/s at 100μv minimum.
POST IF OUTPUT	42 Mc/s at 10 mv minimum.

TABLE 1 - 1 EQUIPMENT SPECIFICATIONS (Cont).

VIDEO OUTPUT	A video output of 2.5 Mc/s bandwidth at 300 ohms is provided for oscilloscope display.
VIDEO PULSE STRETCHING	The video output pulses may be stretched from 0, 25, 150, or 800 microseconds through use of the VIDEO STRETCH USEC Selector Switch.
AUDIO MONITORING:	
PHONES OUTPUT	An output of 100 millivolts minimum is provided for monitoring with a 600 ohm headset; the 600 ohm earphones, EA-112 are available as an accessory.
INTERNAL SPEAKER	An internal speaker provides an audio output of 1 watt minimum.
POWER CHARACTERISTICS:	The Model PS-112-F Power Supply provides all necessary power requirements to the Main Unit and Tuning Module.
AC REQUIREMENTS	105 to 125 VAC, 7.6 A, 50 to 400 c/s.
VOLTAGE REGULATION	Calibration accuracy maintained within $\pm$1.0 DB over input line voltage range from 105 to 125 VAC.
WARMUP TIME	No warmup time is required when switching between Tuning Units after initial warmup period; tubes are heated at all times after initial power application.
STANDBY MODE	The Standby Mode of operation, selected through use of the Main Unit POWER Selector Switch, permits power to be applied to all tubes of the Main Unit and Tuning Module, except for klystron beam power.
KLYSTRON BEAM POWER DELAY	After the Main Unit POWER Selector Switch has been positioned from OFF to KLYSTRON ON, a 45 second delay is encountered before klystron beam power is applied; thereafter, no delay is encountered.

TABLE 1 - 1 EQUIPMENT SPECIFICATIONS (Cont).

UNIT COOLING	The Main Unit and Power Supply are each cooled by separate forced air blowers.
MECHANICAL CHARACTERISTICS:	
WEIGHTS (RACK MOUNT)	
NF-112-F	Approximately 230 pounds.
PS-112-F	Approximately 80 pounds.
TM-112-F	Approximately 115 pounds.
DIMENSIONS (RACK MOUNT)	
NF-112-F	19" Wide x 22-3/4" High x 24-3/4" Deep
PS-112-F	19" Wide x 12-1/4" High x 14-3/5" Deep
TM-112-F	19" Wide x 12-1/4" High x 14-3/5" Deep
SHIELDING	The Main Unit, Power Supply, and Tuning Module are each enclosed in an electrostatically shielded dust cover.
PACKAGING	The Main Unit, Power Supply, and Tuning Module may each be enclosed in an optional cabinet.

1-36. ACCESSORIES.

1-37. Accessory items, not furnished with the instrument, but necessary for system operation and special applications, are listed in Table 1-2. The first part of the table describes standard accessory and antenna kits; the remaining part describes individual items. In the Installation and Operating Procedures that follow, it is assumed that such necessary accessories are available.

1-38. STANDARD ACCESSORY KIT, MODEL KT-112. The Model KT-112 Standard Accessory Kit contains the major items used with the Main Unit for measurements in the 1 to 10 Gc/s frequency range. For radiated measurements, the kit contains a calibrated log periodic antenna, Model LPA-112, with a parabolic reflector Model AT-112, which may be used with the higher frequency antennas. A special horn feed, Model HF-112, is included for highest possible sensitivity in the 6 to 10 Gc/s frequency range. The kit also includes a mounting tripod, TP-112, which may also be used with all of the accessory antennas, and a headset, Model EA-112, for aural monitoring.

1-39. ANTENNA KIT, MODEL KT-112-5. The Model KT-112-5 Antenna Kit contains the major items required to convert the Model KT-112 such that radiated measurements may be made with the Model TM-112-F Waveguide Tuning Unit T-5 in the 10 to 15 Gc/s frequency range. The Model KT-112-5 includes a calibrated 10 to 15 Gc/s horn feed, Model HF-112-5, with a flexible waveguide, Model FW-112-5, for coupling to the Tuning Module.

1-40. ANTENNA KIT, MODEL KT-112-6. A choice of two Model KT-112-6 Antenna Kits are available; Model KT-112-6A Low Gain Antenna Kit and Model KT-112-6B High Gain Antenna Kit. Both kits contain the major items required to make radiated measurements with the Model TM-112-F Waveguide Tuning Unit T-6 in the 15 to 22 Gc/s frequency range. The Model KT-112-6A includes a low gain antenna, Model LGA-112-6A, which mounts to the Model AT-112 Parabolic Reflector, and a flexible waveguide, Model FW-112-6 for coupling to the Tuning Module. The Model KT-112-6B contains a high gain antenna, Model HGA-112-6B, which consists of its own high gain horn and parabolic reflector, and a flexible waveguide, Model FW-112-6 for coupling to the Tuning Module.

1-41. BROADBAND ANTENNA SET, MODEL BB-112. The Model BB-112 Broadband Antenna Set contains a broadband omnidirectional antenna used with the Main Unit for applications in the 1 to 10 Gc/s frequency range. The Model BB-112 is essentially a ground plane antenna, useful for rapid surveillance when the direction of possible signals is unknown.

1-42. INDIVIDUAL ITEMS. The latter part of Table 1-2 lists individual accessory items. Interconnection of these items and the kit items to the Model NF-112-F is illustrated in Figure 2-1.

1-43. The Remote Indicator, Model RE-112-X, and Remote Indicator Cable, Model RC-112-X, are necessary if a meter indication is required at a location remote from the Main Unit. When X-Y plotting is required, the Model RC-112-X is connected to the Model AB-112-X Adaptor Box. The Model AB-112-X adapts the Recorder External Meter Output of the Main Unit so that the output information may be used with most X-Y plotters.

1-44. The Model PA-210 Spectrum Signature Analyzer and its associated equipment is used to provide a panoramic display of the Main Unit pre and post IF Outputs. The Attenuators are used for external range extension, and the Preselectors are used to reject undesirable signals at the input terminals of the instrument.

TABLE 1 - 2. ACCESSORIES.

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
		KITS	
1	Standard Accessory Kit	KT-112	For most applications with the Main Unit; 1 to 10 Gc/s frequency range; consists of the following items (a) through (i).
a	Accessory Carrying Case	AC-112	Houses Model KT-112 items.
b	Antenna Reflector	AT-112	Directional parabolic reflector; 18 inch; used with Model LPA-112, HF-112, HF-112-5, and LGA-112-6A.
c	Log Periodic Antenna	LPA-112	Directional; calibrated; pyramidal feed; 1 to 10 Gc/s frequency range; mounts to Model AT-112.
d	Horn Feed	HF-112	Directional; calibrated; high gain; 6 to 10 Gc/s frequency range; mounts to Model AT-112.
e	Tripod Bag	BG-112	
f	Input Cable	CB-112	Coaxial RF cable; type N; 1 to 10 Gc/s frequency range; couples signal to Main Unit input.
g	Earphones	EA-112	600 ohms; aural monitoring; connects to Main Unit PHONES output.
h	Spanner Wrench	TK-112	Klystron removal.
i	Tripod	TP-112	Used for mounting all antennas.
2	Antenna Kit	KT-112-5	Converts Model AT-112 for use with Model TM-112-F Waveguide Tuning Unit T-5; 10 to 15 Gc/s frequency range; consists of the following items (a) through (d).

TABLE 1 - 2. ACCESSORIES (Cont).

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
		KITS	
a	Accessory Carrying Case	AC-112-5	Houses Model KT-112-5 items.
b	Bracket	BR-112-5	Mounts Model HF-112-5 horn feed to Model AT-112.
c	Flexible Waveguide	FW-112-5	9 foot; type WR-75; 10 to 15 Gc/s frequency range; couples Model HF-112-5 to Model TM-112-F Waveguide Tuning Unit T-5.
d	Horn Feed	HF-112-5	Directional; calibrated; 10 to 15 Gc/s frequency range; mounts to Model AT-112.
3	Antenna Kit (Low Gain)	KT-112-6A	Converts Model AT-112 for use with Model TM-112-F Waveguide Tuning Unit T-6; 15 to 22 Gc/s frequency range; consists of the following items (a) through (c).
a	Accessory Carrying Case	AC-112-6A	Houses Model KT-112-6A items.
b	Flexible Waveguide	FW-112-6	9 foot; type WR-51; 15 to 22 Gc/s frequency range; couples Model LGA-112-6A to Model TM-112-F Waveguide Tuning Unit T-6.
c	Low Gain Antenna	LGA-112-6A	Directional; calibrated; low gain; 15 to 22 G c/s frequency range; mounts to Model AT-112.
4	Antenna Kit (High Gain)	KT-112-6B	Used for high gain radiated measurements with Model TM-112-F Waveguide Tuning Unit T-6; 15 to 22 Gc/s frequency range; consists of the following items (a) through (c).

TABLE 1-2. ACCESSORIES (Cont).

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
		KITS	
a	Accessory Carrying Case	AC-112-6B	Houses Model KT-112-6B items.
b	Flexible Waveguide	FW-112-6	9 foot; type WR-51; 15 to 22 Gc/s frequency range; couples Model HGA-112-6B to Model TM-112-F Waveguide Tuning Unit T-6.
c	High Gain Antenna	HGA-112-6B	Directional; calibrated; high gain; 15 to 22 Gc/s frequency range; equipped with its own 18 inch parabolic reflector.
5	Broadband Antenna Set	BB-112	Omnidirectional; broadband; qualitative; 1 to 10 Gc/s frequency range.
		INDIVIDUAL ITEMS	
6	Adapter Box	AB-112-X	Used to adapt Main Unit Recorder-External Meter Output to X-Y Plotter; connects to Model RC-112-X Remote Meter Cable. NOTE A variety of EMPIRE Fixed or Step, Coaxial or Waveguide, Broadband Microwave Frequency Attenuators are available. Items (7) through (9) describe the most applicable ones.
7	Fixed Attenuator	AT-160-3	Coaxial; 3 DB; 2W; DC to 10 Gc/s.
8	Fixed Attenuator	AT-160-20	Coaxial; 20 DB; 2W; DC to 10 Gc/s.
9	Waveguide Attenuator	AW-751	Waveguide; 3, 6, 10, 20, 30, and 40 DB; other values to user's specification; 1 W; 10 to 15 Gc/s; mates to WR-75 waveguide or to Model TM-112-F Waveguide Tuning Unit T-5.

TABLE 1 - 2. ACCESSORIES (Cont).

ITEM NO.	DESCRIPTION	MODEL NO.	APPLICATION
		INDIVIDUAL ITEMS	
10	Spectrum Signature Analyzer	PA-210	Provides a spectrum display of the Main Unit pre and post IF outputs; used with the following items (a) through (c).
a	Cable	CB-210	
b	Tuning Unit	T-3/PA-210	Required for 42 Mc/s post IF Output display.
c	Tuning Unit	T-4/PA-210	Required for 60 Mc/s pre IF Output display.
11	Microwave Preselector	PF-190A	Tunable rejection filter; 0.85 to 2.1 Gc/s frequency range.
12	Microwave Preselector	PF-190B	Tunable rejection filter; 2 to 4 Gc/s frequency range.
13	Microwave Preselector	PF-190C	Tunable rejection filter; 3.9 to 7.2 Gc/s frequency range.
14	Microwave Preselector	PF-190D	Tunable rejection filter; 7 to 10 Gc/s frequency range.
15	Remote Indicator Cable	RC-112-X	Connects to Model AB-112-X or RE-112-X; 25 foot.
16	Remote Indicator	RE-112-X	Contains a meter duplicating the Main Unit front panel Indicating Meter; connects to Model RC-112-X cable.
17	Cabinet Rack (NF-112-F)		Encloses the Main Unit and dust cover for bench operation.
18	Cabinet Rack (PS-112-F)		Encloses the Power Supply and dust cover for bench operation.
19	Cabinet Rack (TM-112-F)		Encloses the Tuning Module and dust cover for bench operation.

SECTION 2

INSTALLATION

2-1. GENERAL.

2-2. This section describes the Installation Procedures for the Model NF-112-F Noise and Field Intensity Meter System and its associated equipment. These include initial inspection, interconnections, and installation checks. (See Figure 2-1 for equipment interconnections.)

2-3. The instruments have been thoroughly inspected and calibrated prior to shipment. Uncrating and handling of the units requires only normal precautions applicable to equipment of this type.

2-4. INITIAL INSPECTION.

2-5. After removing the instruments from their shipping containers, carefully inspect the exterior of the instruments for any damage which may have occurred during shipment. Rotate all controls and/or switches throughout their complete range, checking for freedom of operation and positive detent locking. Pull out the Main Unit SIGNAL INPUT ATTEN (DB) Selector Switch, rotate to adjacent position, push-in, check for positive detent locking, and repeat for all positions.

CAUTION

Turning the SIGNAL INPUT ATTEN (DB) Selector Switch without first pulling forward may damage the attenuators. Use extreme caution when operating this switch.

2-6. TEST CONDITIONS.

2-7. Refer to the applicable test specification for information concerning equipment arrangement and operating methods.

2-8. MOUNTING.

2-9. The instruments are enclosed in individual dust covers. They may be used as is, mounted in their optional cabinets, or mounted in standard 19 inch relay racks. To mount in the cabinet or relay rack, simply slide the instrument and dust cover into the cabinet or rack, and fasten all front panel holding screws.

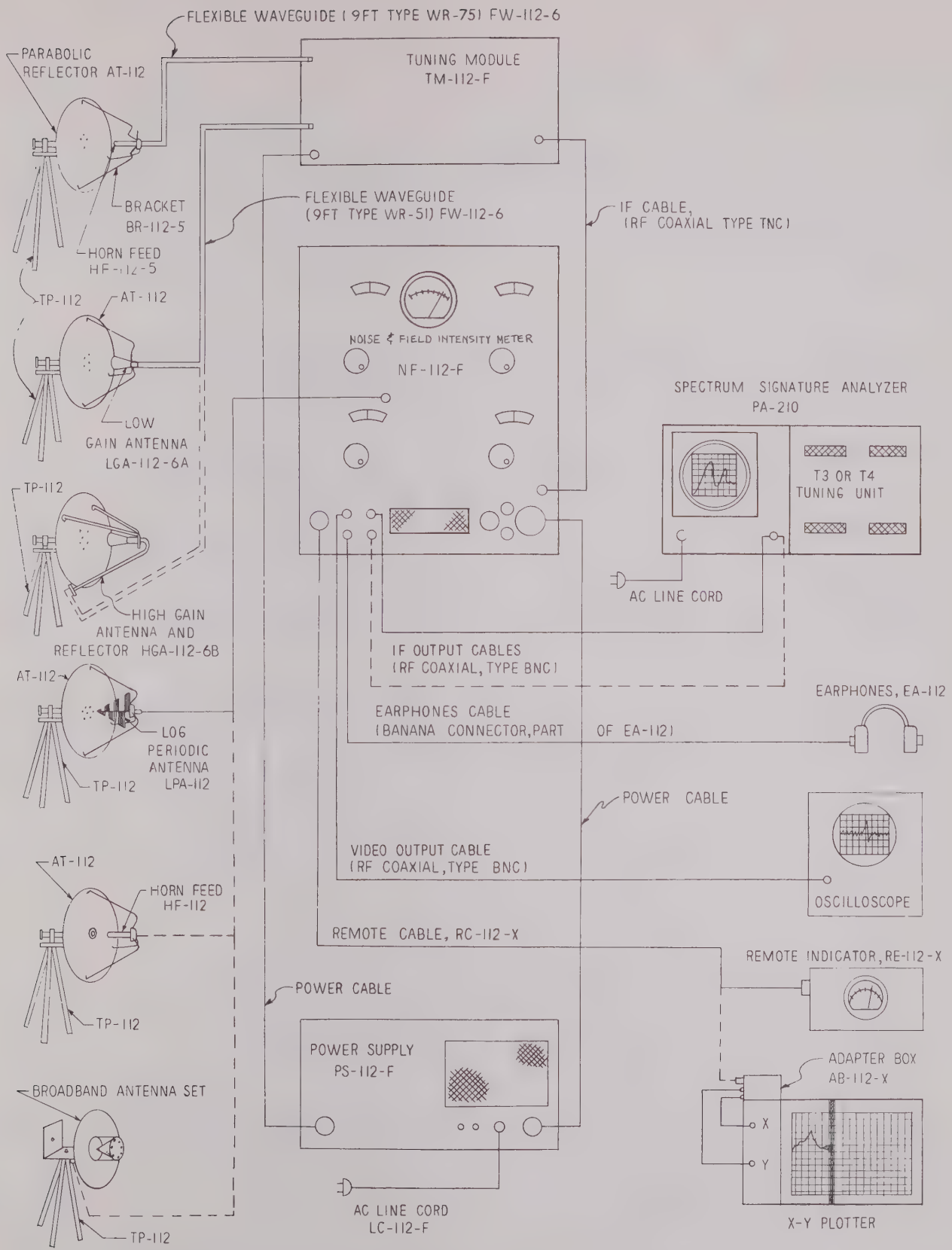


FIGURE 2-1. NOISE AND FIELD INTENSITY METER SYSTEM, MODEL NF-112-F INTERCONNECTIONS.

2-10. INTERCONNECTIONS.

2-11. Interconnections between the Main Unit, Power Supply, and Tuning Module, as well as to the various pickup antennas and readout devices, are illustrated in Figure 2-1. These connections should be made, as required, before any attempt is made to operate the equipment.

2-12. INSTALLATION CHECKS.

2-13. After the units have been initially unpacked and inspected, interconnect the units and perform the following Installation Checks. This procedure is designed to check the operability of the Main Unit.

2-14. Two adjustments may be necessary during the Installation Check; electrical meter zero and the impulse generator contact adjustment. These adjustments are described below.

2-15. ELECTRICAL METER ZERO. Electrical zero of the Main Unit front panel Indicating Meter is accomplished through use of the front panel ZERO ADJ Control. This adjustment should be checked each time measurements are to be performed, and is accomplished after initial equipment warmup.

2-16. IMPULSE GENERATOR CONTACT ADJUSTMENT. The purpose of the CONTACT ADJUST front panel screwdriver adjustment is to control the spacing of the impulse generator's mechanical vibrator contacts. The nature of the adjustment is such that after once being properly set, further adjustments should be infrequent.

2-17. The Installation Checks should be performed in the listed order:

CAUTION

Before performing this procedure, refer to Section 3 (OPERATION) for nomenclature and function of all front panel controls. Incorrect positioning of controls may result in malfunction or damage to the equipment.

2-18. PRELIMINARY CONTROL SETTINGS. Set the Main Unit front panel controls to the following positions:

CONTROL	POSITION
POWER Selector Switch	OFF
IMPULSE GEN DBMC Selector Switch.	53

CONTROL (cont)	POSITION
SLIDEBACK Control	Counterclockwise
GAIN control	Mid position
VOLUME Control	Mid position
Meter Function Selector Switch	ZERO ADJ
Scan Mode Selector Switch	MANUAL

CAUTION

The SIGNAL INPUT ATTEN (DB) Selector Switch (PULL-TURN-PUSH) must be pulled out before being turned. Turning without first pulling forward may damage the attenuator. Upon lining up the dot on the control with the desired position, push the control all the way in.

SIGNAL INPUT ATTEN (DB) Selector Switch	20
Input Function Selector Switch	CALIBRATE
VIDEO STRETCH USEC Selector Switch	800
Bandwidth Selector Switch	WIDE
AFC Selector Switch	OFF

2-19. MECHANICAL METER ZERO.

a. Check that the Main Unit meter pointer indicates zero.

b. If the meter indicates other than zero, adjust the screw located on the meter face until it does.

2-20. POWER TURN-ON.

a. Ensure that the Power Supply is properly fused; 2 and 6.25 AMP SLO-BLO, as indicated on the front panel.

b. Position the POWER Selector Switch to STANDBY.

c. Observe that the red STANDBY Indicator illuminates.

d. Allow a 5 minute warmup.

CAUTION

When the POWER Selector Switch is positioned to STANDBY, all heater and control voltages are applied to the instrument,

except for klystron beam power. When positioned to KLYSTRON ON, beam power is applied, and the instrument is fully capable of performing measurements. In order to insure maximum useful life of the klystrons, the POWER Selector Switch should be positioned to STANDBY when checks or measurements are not being performed.

e. Position the POWER Selector Switch to KLYSTRON ON.

NOTE

If the POWER Selector Switch is positioned directly from OFF to KLYSTRON ON without a warmup period, a 45 second delay will be encountered before the amber KLYSTRON ON Indicator illuminates.

f. Observe that the time delay for the amber KLYSTRON ON Indicator to illuminate is approximately 40 to 60 seconds.

2-21. ELECTRICAL METER ZERO CHECK AND ADJUSTMENT.

a. Check that the front panel meter pointer reads zero.

b. If the meter does not indicate zero, vary the ZERO ADJ Control until it does.

NOTE

Do not change the position of the ZERO ADJ Control during the measurement procedure.

2-22. IMPULSE GENERATOR CONTACT CHECK AND ADJUSTMENT.

a. Position the Meter Function Selector Switch to PEAK.

CAUTION

In order to insure maximum useful life of the impulse generator contacts, the IMP GEN PUSH TO OPR Pushbutton should be depressed only when necessary to activate the impulse generator for adjustment or calibration purposes.

b. Depress the IMP GEN PUSH TO OPR Pushbutton, listen for an audible tone from the internal speaker, and note that the meter deflects.

c. If an audible tone is not heard, or if the tone is not clear, the CONTACT ADJUST control requires adjusting.

CAUTION

Do not force the CONTACT ADJUST adjustment by rotating the control to either extreme; damage to the impulse generator contacts may ensue.

d. Slowly vary the CONTACT ADJUST control 1 or 2 turns in either direction until the clearest tone is heard (a clockwise rotation increases the contact spacing).

2-23. CONTROL OPERABILITY CHECK.

a. Rotate the VOLUME Control clockwise, and note that the tone heard from the internal speaker increases.

b. Rotate the GAIN Control clockwise, and note that the meter indication increases.

c. Position the Bandwidth Selector Switch to NARROW, note that the meter indication decreases 12 to 14 DB, and position the Bandwidth Selector Switch back to WIDE.

d. Position the BAND SELECTOR Switch consecutively from BAND 1 through 4, and note that the meter deflects for each position.

e. Position the IMPULSE GEN DBMC Selector Switch from 53 to 42, and note that for each position the meter indication decreases.

2-24. AURAL SLIDEBACK CHECK.

a. Position the Meter Function Selector Switch to SLIDEBACK.

b. Rotate the SLIDEBACK Control clockwise, and note that the audible tone decreases, and then finally becomes inaudible.

c. Release the IMP GEN PUSH TO OPR Pushbutton to shut the impulse generator off.

2-25. SCANNING MECHANISM CHECK.

a. Rotate the applicable Tuning Control until the corresponding Frequency Indicator Dial indicates the low frequency limit.

b. Position the Scan Mode Selector Switch to FULL SCAN OPR, and note that the applicable Frequency Indicator Dial scans toward the high frequency end.

c. Vary the SCAN SPEED Control, and note that the scan rate varies accordingly.

d. Position the Scan Mode Selector Switch to MANUAL, and note that the scanning of the Frequency Indicator Dial stops.

e. Position the Scan Mode Selector Switch back to FULL SCAN OPR, and note that the scanning operation stops when the high frequency limit of the Frequency Indicator Dial is reached.

f. Position the Scan Mode Selector Switch to FULL SCAN RET, and note that the Frequency Indicator Dial returns to the low frequency limit at maximum speed (not controlled by the SCAN SPEED Control).

g. Position the Scan Mode Selector Switch to SECTOR SCAN HI, and allow the Frequency Indicator Dial to stop.

h. Adjust the applicable SECTOR SCAN SET high frequency limit control to bring the Frequency Indicator Dial to a stop at an arbitrary high frequency limit of the sector to be scanned.

i. Position the Scan Mode Selector Switch to SECTOR SCAN LO, and allow the Frequency Indicator Dial to stop.

j. Adjust the applicable SECTOR SCAN SET low frequency limit control to bring the Frequency Indicator Dial to a stop at an arbitrary low frequency limit of the sector to be scanned.

k. Position the Scan Mode Selector Switch to SECTOR SCAN OPR, and note that the applicable Frequency Indicator Dial scans between the selected frequency limits.

l. Position the Scan Mode Selector Switch to MANUAL, and note that the scanning of the Frequency Indicator Dial stops.

m. Repeat steps (a) through (l) for each of the bands 1 through 4 of the BAND SELECTOR Switch.

2-26. PHONES OUTPUT CHECK.

a. Connect the Model EA-112 Earphones to the PHONES Output Jack.

b. Position the Meter Function Selector Switch to PEAK.

c. Depress the IMP GEN PUSH TO OPR Pushbutton, listen for an audible tone in the earphones, and release the IMP GEN PUSH TO OPR Pushbutton.

2-27. VIDEO OUTPUT CHECK.

a. Connect an oscilloscope to the VIDEO OUTPUT Jack.

b. The video pulse stretching circuitry may be checked by setting the VIDEO STRETCH USEC Selector Switch to each of its positions, activating the impulse generator, and observing the oscilloscope display.

2-28. IF OUTPUT CHECK.

a. Connect the Model PA-210 Spectrum Signature Analyzer to the 60 Mc/s and 42 Mc/s IF OUTPUT Jack.

b. The IF Outputs may be checked by activating the impulse generator, and observing the Model PA-210 display.

2-29. EXTERNAL METER OUTPUT CHECK.

a. Connect the Model RC-112-X Remote Indicator Cable between the Model RE-112-X Remote Indicator and the RECORDER EXT METER Jack.

b. The amplitude information output may be checked by activating the impulse generator, and observing that both the meter on the Main Unit and the remote meter deflect.

2-30. POWER TURN-OFF

a. If the equipment is to remain in a standby condition, position the POWER Selector Switch to STANDBY.

b. If the equipment is not to be used for an extended period of time, position the POWER Selector Switch to OFF.

SECTION 3

OPERATION

3-1. GENERAL.

3-2. Section 3 provides a description of front panel controls, indicators, and connectors, and describes operating procedures. Calibration, antenna factor, and conversion charts are provided at the end of this section.

3-3. MAIN UNIT FRONT PANEL.

3-4. Figure 3-1 locates the Main Unit front panel operating controls, indicators, and connectors. The index numbers of Figure 3-1 are included in Table 3-1 which lists all control, indicator, and connector nomenclature and function.

TABLE 3-1. MAIN UNIT FRONT PANEL .

INDEX NO.	NOMENCLATURE	FUNCTION
1	SECTOR SCAN SET (BAND 2) Controls	(a) Upper Frequency Limit Control (large outer knob) sets the high frequency scan limit of Band 2. (b) Lower Frequency limit Control (small inner knob) sets the low frequency scan limit of Band 2. (c) Upper and Lower Frequency Limit Controls may be adjusted when Scan Mode Selector Switch is positioned to SECTOR SCAN HI and LO, respectively. (d) A screwdown clamp locks both SECTOR SCAN SET Controls, preventing inadvertant adjustments.

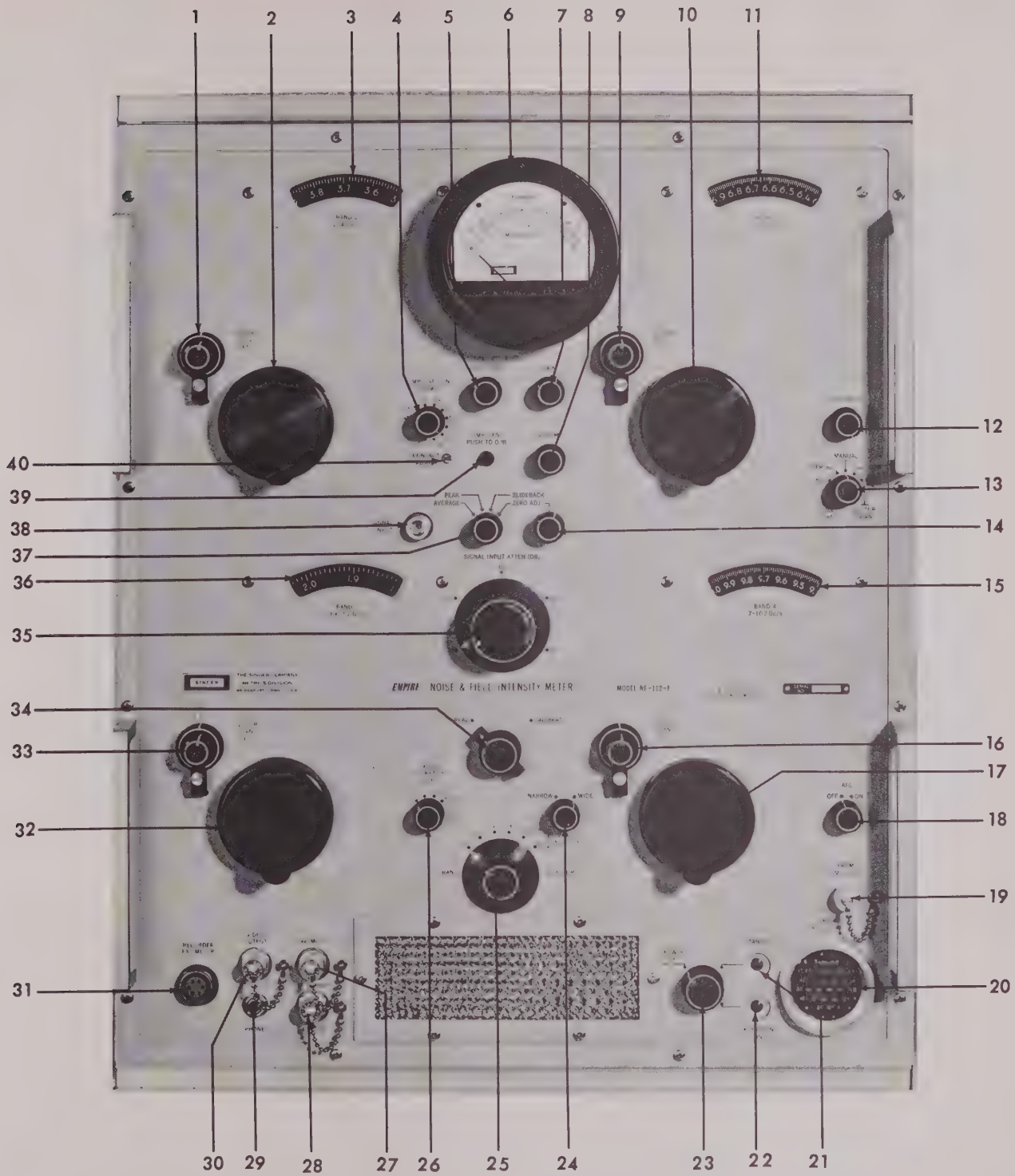


Figure 3-1. Main Unit Front Panel

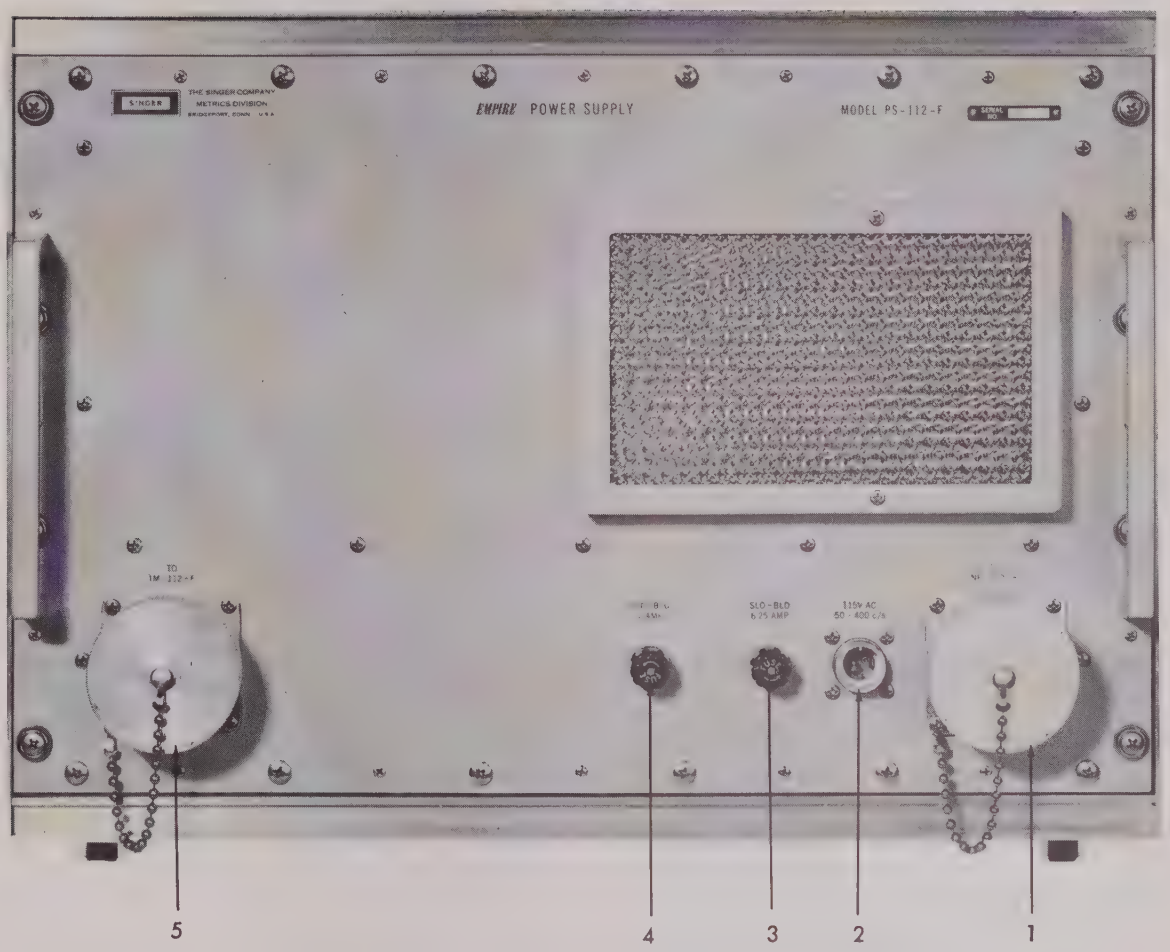


Figure 3-2. Power Supply Front Panel

Table 3-1. Main Unit Front Panel(Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
2	Tuning Control (BAND 2)	(a) Used to manually tune Band 2 through its 2 to 4 Gc/s frequency range. (b) This control is motor driven during FULL SCAN and SECTOR SCAN Modes.
3	Frequency Indicator Dial BAND 2 (2-4 Gc/s)	Indicates the frequency in Gigacycles that Band 2 is tuned to.
4	IMPULSE GEN DBMC Selector Switch	(a) Selects Impulse Generator output level in 1 DB increments from 42 to 53 DB above 1 microvolt per Megacycle which is the unit of measurement for broadband noise. (b) The Impulse Generator functions only when the IMP GEN PUSH TO OPR Pushbutton is depressed.
5	SLIDEBACK Control	(a) Adjusts the biasing level of the Audio Detector, reducing the PHONES and Speaker Audio Outputs to the threshold of audibility. (b) Enables peak measurements of impulse signals, utilizing the discrimination capabilities of the ear. (c) Functions only when the Meter Function Selector Switch is positioned to SLIDEBACK.
6	Indicating Meter	Indicates the level of the incoming signal in microvolts (5 to 100) and in decibels (+ 14 to + 40).

Table 3-1. Main Unit Front Panel (Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
7	GAIN Control	(a) Adjusts the gain of the system by controlling the biasing level of several stages of the 60 Mc/s IF Amplifier. (b) Used to adjust the Indicating Meter to a reference level during calibration and measurement.
8	VOLUME Control	Adjusts the level of the PHONES and Speaker Audio Outputs.
9	SECTOR SCAN SET (BAND 3) Controls	Same as Index No. 1, except applicable to Band 3.
10	Tuning Control (BAND 3)	Same as Index No. 2, except applicable to Band 3.
11	Frequency Indicator Dial BAND 3 (3.9-7.1 Gc/s)	Same as Index No. 3, except applicable to Band 3.
12	SCAN SPEED Control	Adjusts the speed at which the frequency range of each band is swept when the Scan Mode Selector Switch is positioned to FULL SCAN OPR or SECTOR SCAN OPR.
13	Scan Mode Selector Switch:	
	FULL SCAN RET Position	Returns the Frequency Indicator Dial to the low frequency end of the band at maximum speed.
	FULL SCAN OPR Position	Enables the Frequency Indicator Dial of each band to sweep from the low frequency end to the high frequency end of the band, at a rate determined by the SCAN SPEED Control.

Table 3-1. Main Unit Front Panel (Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
	MANUAL Position	Enables the Tuning Control of each band to be manually operated.
	SECTOR SCAN OPR Position	(a) Enables each band to cover a predetermined sector of the frequency range. (b) The individual SECTOR SCAN SET Controls determine the low and high frequency limits of the desired sector for each band.
	SECTOR SCAN HI Position	Permits adjustment of the Upper Frequency Limit SECTOR SCAN SET Control for each band.
	SECTOR SCAN LO Position	Permits adjustment of the Lower Frequency Limit SECTOR SCAN SET Control for each band.
14	ZERO ADJ Control	(a) Adjusts Indicating Meter to zero position before calibration and measurement. (b) Functions only when the Meter Function Selector Switch is positioned to ZERO ADJ.
15	Frequency Indicator Dial BAND 4 (7-10.2 Gc/s)	Same as Index No. 3, except applicable to Band 4.
16	SECTOR SCAN SET (BAND 4) Controls	Same as Index No. 1, except applicable to Band 4.
17	Tuning Control (BAND 4)	Same as Index No. 2, except applicable to Band 4.
18	AFC ON/OFF Selector Switch	Activates the AFC discriminator circuitry, permitting the instrument to lock-in and hold a signal.

Table 3-1. Main Unit Front Panel (Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
19	FROM TM-112-F Connector	Couples the 348 Mc/s IF Output from the Model TM-112-F Tuning Module to the Main Unit.
20	FROM PS-112-F Connector	Couples filament, power, and control signals from the Power Supply to the Main Unit.
21	STANDBY Indicator	(a) Illuminates red when the POWER Selector Switch is positioned to STANDBY or KLYSTRON ON. (b) Indicates that the Power Supply is activated.
22	KLYSTRON ON Indicator	(a) Illuminates amber after the POWER Selector Switch has been positioned to KLYSTRON ON for at least 45 seconds. (If the POWER Selector Switch has been positioned to STANDBY for 45 seconds or more, no additional delay is encountered.) (b) Indicates that beam power is being supplied to the klystron of the selected Tuning Unit.
23	POWER Selector Switch:	
	OFF Position	Disconnects the AC line power from the Power Supply, deactivating the Main Unit, Power Supply, and Tuning Module.
	STANDBY Position	(a) Activates all Power Supply circuits except klystron beam power. (b) Illuminates STANDBY Indicator red.

Table 3-1. Main Unit Front Panel (Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
	POWER Selector Switch (Cont.)	
	KLYSTRON ON Position	(a) Applies klystron beam power to the selected Tuning Unit after an initial delay. (The delay is approximately 45 seconds if the POWER Selector Switch is positioned from OFF to KLYSTRON ON, directly.) (b) Illuminates KLYSTRON ON Indicator amber when klystron beam power is applied.
24	Bandwidth Selector Switch:	Selects on the two bandwidths.
	NARROW Position	The bandwidth for this position is 600 Kc/s.
	WIDE Position	The bandwidth for this position is 3 Mc/s.
25	BAND SELECTOR Switch	Selects one of the following Frequency Bands: BAND 1. . . .0.9-2.1 Gc/s BAND 2. . . . . 2-4 Gc/s BAND 3. . . .0.9-7.1 Gc/s BAND 4. . . . .7-10.2 Gc/s BAND 5. . . . 10-15 Gc/s BAND 6. . . . 15-22 Gc/s
26	VIDEO STRETCH USEC Selector Switch	Selects the amount of stretching of the VIDEO OUTPUT pulse of 0, 25, 150, or 800 microseconds.
27	60 Mc/s IF OUTPUT Jack	Provides a Pre IF Output for Spectrum Signature Analyzer display.

Table 3-1. Main Unit Front Panel (Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
28	42 Mc/s IF OUTPUT Jack	Provides a Post IF Output for Spectrum Signature Analyzer display.
29	PHONES Output Jack	Provides an Audio Output for aural monitoring.
30	VIDEO OUTPUT Jack	Provides a Video Output for oscilloscope display.
31	RECORDER/EXT METER Output Connector	(a) Provides amplitude information duplicating that of the front panel meter as an output to an external Remote Indicator. (b) Provides the above amplitude information as the Y Coordinate Output for X-Y Plotting. (c) Provides a 0 to 10 volt DC output, varying as a linear function of the frequency of the band being used, as the X Coordinate Output for X-Y Plotting.
32	Tuning Control (BAND 1)	Same as Index No. 2, except applicable to Band 1.
33	SECTOR SCAN SET (BAND 1) Controls	Same as Index No. 1, except applicable to Band 1.
34	Input Function Selector Switch:	
	READ Position	Couples incoming signal from the SIGNAL INPUT Jack to the Signal Input Attenuator for measurement purposes.
	CALIBRATE Position	Couples output of Impulse Generator to the Signal Input Attenuator for calibration purposes.

Table 3-1. Main Unit Front Panel (Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
35	SIGNAL INPUT ATTEN (DB) Selector Switch	(a) Selects 0, 20, 40, 60, or 80 DB of attenuation of the Input Signal. (b) Inserts the following attenuators, before each Tuning Unit, for positions 0 to 80 DB, respectively. 0 DB. . . . . 0 DB 20 DB. . . . . 0 DB 40 DB. . . . . .20 DB 60 DB. . . . . .40 DB 80 DB. . . . . .60 DB (c) Inserts an additional attenuation of 20 DB in the IF circuitry for all positions, except 0 DB.
36	Frequency Indicator Dial BAND 1 (0.9-2.1 Gc/s)	Same as Index No. 3, except applicable to Band 1.
37	Meter Function Selector Switch:	
	AVERAGE Position	Enables the equipment to measure the average value of CW signals.
	PEAK Position	Enables the equipment to measure the true peak value of any type of incoming signal (impulse, modulated CW, unmodulated CW).
	SLIDEBACK Position	Enables the equipment to measure the peak value of incoming signals that are sporadic, of low repetition rates, or of different amplitudes.
	ZERO ADJ Position	Enables the ZERO ADJ Control to be used to electrically zero the Indicating Meter.

Table 3-1. Main Unit Front Panel (Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
38	SIGNAL INPUT Connector	Connects the Input Signal from the Pickup Device, and couples the signal to the SIGNAL INPUT ATTEN (DB) Selector Switch.
39	IMP GEN PUSH TO OPR Pushbutton	When depressed, activates the Impulse Generator.
40	CONTACT ADJUST Screwdriver Adjustment	Controls the spacing of the Impulse Generator mechanical vibrator contacts.

3-5. POWER SUPPLY FRONT PANEL.

3-6. Figure 3-2 locates the Power Supply front panel connectors and fuses. The index numbers of Figure 3-2 are included in Table 3-2 which lists the connector and fuse nomenclature and function.

TABLE 3-2. POWER SUPPLY FRONT PANEL.

INDEX NO.	NOMENCLATURE	FUNCTION
1	TO NF-112-F Connector	(a) Couples filament, power, and control signals from the Model PS-112-F Power Supply to the Model NF-112-F Main Unit. (b) Connects to the Power Cable PC-112-F (NF), which in turn connects to the (FROM PS-112-F) Connector on the Main Unit.
2	115V AC 50-400 c/s Connector	(a) Couples AC line voltage to the Power Supply. (b) Connects to AC Line Cord LC-112-F, which in turn connects to the AC line power source.

Table 3-2. POWER SUPPLY FRONT PANEL (Cont.)

INDEX NO.	NOMENCLATURE	FUNCTION
3	SLO-BLO 6.25 AMP Fuse	Provides overload protection for the major Power Supply circuits which are activated when the Main Unit POWER Selector Switch is positioned to STANDBY or KLYSTRON ON.
4	SLO-BLO 2 AMP Fuse	Provides overload protection for the Power Supply circuits which are activated only when the Main Unit POWER Selector Switch is positioned to KLYSTRON ON.
5	TO TM-112-F Connector	(a) Couples filament, power, and control signals from the Model PS-112-F Power Supply to the Model TM-112-F Tuning Module. (b) Connects to the Power Cable PC-112-F (TM), which in turn connects to the (FROM PS-112-F) Connector on the Tuning Module.

3-7. METHODS OF MEASUREMENT.

3-8. There are two basic parameters which may be measured with the Model NF-112-F System; RF Voltage and Field Strength. For the RF Voltage mode of operation, the equipment measures the two terminal (conducted) RF voltage of various waveforms applied directly to the input terminals, an antenna not being utilized. For the Field Strength mode of operation, an antenna is used as the pickup device, and the equipment measures the radiated field strength of a variety of RF signal types. Both of these modes of operation may be further classified as CW (narrow band) and broadband noise. For the purpose of explaining applications and operating procedures, measurements are classed in the following four general categories:

a. TWO TERMINAL CW
b. TWO TERMINAL BROADBAND NOISE
c. RADIATED CW
d. RADIATED BROADBAND NOISE

3-9. A different unit of measurement is used for each category. They are: voltage, voltage per unit bandwidth, voltage per meter, and voltage per unit bandwidth per meter, respectively. The categories are explained in terms of the normal application for each unit of measurement. Categories (a) and (b) are two terminal RF voltage measurements, and categories (c) and (d) are field intensity measurements. Categories (a) and (b) are narrow band measurements, and categories (c) and (d) are broadband measurements. Noise signals are usually broadband, and communication signals are usually narrow band. For all measurements, the user must determine the components constituting signal and those of noise.

3-10. TWO TERMINAL CW. The instrument measures the intensity of modulated or unmodulated narrow band CW signals in terms of voltage. Narrow band CW signals are those which are sharply tunable, having a spectrum that is less than the bandpass of the circuitry or unit receiving the signal. The signal usually consists of a carrier wave and its necessary modulation sidebands. Therefore, narrow band CW measurements are more applicable for carrier signals than noise, although noise may also be generated as a sharply tunable, narrow spectrum.

3-11. Two Terminal CW measurements are performed using the direct reading method of measurement. Two Terminal CW measurements are expressed in the following units:

a. Microvolts (uv)

b. Decibels above one microvolt (DB)

3-12. The direct reading method of making Two Terminal CW measurements is the most conventional and accurate method at any one calibration frequency. For this method, the internal Impulse Generator is used to calibrate the Main Unit Indicating Meter to a known level. The instrument then becomes direct reading, measuring the input signal directly, in terms of voltage.

3-13. TWO TERMINAL BROADBAND NOISE. The instrument measures the intensity of broadband noise signals in terms of voltage per unit bandwidth. Broadband signals are those having a wide spectrum composed of many component waveforms. The waveforms usually have no communication intelligence content and therefore are considered noise.

3-14. Two Terminal Broadband Noise measurements are expressed in the following units:

a. Microvolts per megacycle of bandwidth (uv/MC).

b. Decibels above one microvolt per megacycle of bandwidth (DBMC).

3-15. Two Terminal Broadband Noise measurements are made using the direct reading (meter), or aural slideback (speaker or phones) method of indication.

3-16. The direct reading method of making Two Terminal Broadband Noise measurements is the most conventional and accurate method at any one calibration frequency. For this method, the internal Impulse Generator is used to calibrate the Main Unit Indicating Meter to a known level. The instrument then becomes direct reading, measuring the input signal directly, in terms of voltage per unit bandwidth.

3-17. The aural slideback method offers two advantages over the direct reading method. It makes possible differentiation between two or more types of interference simultaneously present; also, it may be used at very low repetition rates or for single pulses.

3-18. RADIATED CW. The instrument measures the field intensity of narrow band CW signals in terms of voltage per meter. Radiated CW measurements differ from Two Terminal CW measurements in that the radiated method of coupling is used, and the effective height (reception characteristics) of the coupling antenna is taken into account.

3-19. Radiated CW measurements are performed in the same manner as Two Terminal CW measurements, except for the use of an antenna. Radiated CW measurements, made with a calibrated antenna, are expressed in the following units:

a. Microvolts per meter (uv/meter).

b. Decibels above one microvolt per meter (DB/meter).

3-20. RADIATED BROADBAND NOISE. The instrument measures the field intensity of broadband noise signals in terms of voltage per unit bandwidth per meter. Radiated Broadband Noise measurements differ from Two Terminal Broadband Noise measurements in that the radiated method of coupling is used, and the effective height (reception characteristics) of the coupling antenna is taken into account.

3-21. Radiated Broadband Noise measurements are performed in the same manner as Two Terminal Broadband Noise measurements, except for the use of an antenna. Radiated Broadband Noise measurements, made with a calibrated antenna are expressed in the following units:

a. Microvolts per megacycle of bandwidth per meter (uv/MC/meter).

b. Decibels above one microvolt per megacycle of bandwidth per meter (DBMC/meter).

3-22. OPERATING PROCEDURES.

3-23. The following paragraphs describe operating procedures for the Model NF-112-F Noise and Field Intensity Meter System.

3-24. TWO TERMINAL CW MEASUREMENTS. CW measurements of two terminal RF voltage are made using the Direct Reading (Meter) Method.

3-25. Direct Reading (Meter) Method. The following procedure calibrates the instrument so that direct reading two terminal measurements may be made in terms of voltage or decibels. This is the most accurate method of any one calibration frequency.

a. Connect the signal to be measured directly, or through the Model CB-112 Input Cable (RF coaxial, type N), to the Main Unit SIGNAL INPUT Jack.

b. Ensure that the Main Unit front panel controls are positioned as follows:

CONTROL	POSITION
IMPULSE GEN DBMC Selector Switch.	53
Meter Function Selector Switch.	ZERO ADJ
Scan Mode Selector Switch.	MANUAL
Input Function Selector Switch.	CALIBRATE
Bandwidth Selector Switch.	WIDE
AFC Selector Switch.	OFF

c. Adjust the applicable Tuning Control until the corresponding Frequency Indicator Dial indicates the desired calibration frequency. (Refer to the applicable calibration chart, Figure 3-3 through 3-8.)

d. Position the SIGNAL INPUT ATTEN (DB) Selector Switch to the desired setting listed in the applicable calibration chart.

e. Position the **POWER** Selector Switch to **KLYSTRON ON**.

f. Observe that the amber **KLYSTRON ON** Indicator illuminates.

g. Check that the front panel Indicating Meter pointer reads zero.

h. If the meter does not indicate zero, vary the **ZERO ADJ** Control until it does.

NOTE

Do not change the position of the **ZERO ADJ** Control during the remainder of this procedure.

i. Position the **Meter Function Selector Switch** to **PEAK**.

CAUTION

In order to insure maximum useful life of the impulse generator contacts, the **IMP GEN PUSH TO OPR** Pushbutton should be depressed only when required.

j. Depress the **IMP GEN PUSH TO OPR** Pushbutton and observe the Indicating Meter.

k. Adjust the **GAIN** Control until the meter indicates the desired reading listed in the applicable calibration chart.

l. Release the **IMP GEN PUSH TO OPR** Pushbutton to shut the impulse generator off.

NOTE

Do not readjust the **GAIN** Control during the remainder of this calibration procedure or while measurements at this calibration frequency are being made. If measurements are to be made at other frequencies, this complete procedure must be repeated for the new calibration frequency, and the **GAIN** Control may require readjusting.

m. For Two Terminal CW measurements with the SIGNAL INPUT ATTEN (DB) Selector Switch positioned to 20, the instrument is now calibrated for a full scale sensitivity of 60 DB above 1 uv (1,000 u volts). The sensitivity may be increased or decreased in 20 DB steps by changing the setting of the SIGNAL INPUT ATTEN (DB) Selector Switch.

n. Full scale sensitivity for each position of the SIGNAL INPUT ATTEN (DB) Selector Switch is as follows:

SIGNAL INPUT ATTEN (DB) Selector Switch		Full Scale Sensitivity (Two Terminal CW)
0 DB	100 uv	= 40 DB above 1 uv
20 DB	1,000 uv	= 60 DB above 1 uv
40 DB	10,000 uv	= 80 DB above 1 uv
60 DB	100,000 uv	=100 DB above 1 uv
80 DB	1,000,000 uv	=120 DB above 1 uv

o. Position the Input Function Selector Switch to READ.

p. Position the Meter Function Selector Switch to AVERAGE for average measurements of incoming CW signals; leave in the PEAK position for peak measurements.

q. Adjust the SIGNAL INPUT ATTEN (DB) Selector Switch for an on-scale meter indication.

r. The setting of the SIGNAL INPUT ATTEN (DB) Selector Switch, plus the meter indication (in DB) is the actual average or peak level (in DB) of the incoming narrow band carrier signal as it appears at the Main Unit SIGNAL INPUT Jack.

NOTE

To convert DB above 1 uv to microvolts, see Figure 3-9.

s. For measurement of low level narrow band signals, maximum sensitivity may be attained by positioning the Bandwidth Selector Switch to NARROW.

t. For measurement of steady state incoming signals over a long period of time, locking-in and holding of the signal may be attained by positioning the AFC Selector Switch to ON.

u. After all direct reading measurements have been performed at this calibration frequency, and direct reading measurements are to be performed at other calibration frequencies, position the POWER Selector Switch to STANDBY, and repeat this complete procedure.

v. If the equipment is to be used for other types of measurements, position the POWER Selector Switch to STANDBY, and proceed to the applicable procedure.

w. If no other measurements are to be made, or the equipment is not to be used for an extended period of time, turn the equipment off by positioning the POWER Selector Switch to OFF.

3-26. In the presence of high ambient interference or hiss level, an accurate Carrier Intensity measurement may be performed in the following manner:

a. Note the meter reading in microvolts produced by the combined noise and carrier levels.

b. Detune the instrument sufficiently to lose the carrier signal.

c. Note the reading of noise alone.

d. Apply the following formula to determine the carrier signal level:

$$S = \sqrt{A^2 - N^2}$$

e. S is the unknown carrier signal level, A is the combined noise and carrier level, and N is the noise level (all in microvolts). For example, if the combined noise and signal level is 50 microvolts, and the noise level is 30 microvolts, the true signal level would be:

$$S = \sqrt{50^2 - 30^2}$$

$$= 40 \text{ microvolts}$$

3-27. TWO TERMINAL BROADBAND NOISE MEASUREMENTS. Broadband Noise measurements may be made using the direct reading (meter), or aural slideback (speaker or phones) methods.

3-28. Direct Reading (Meter) Method. The following procedure calibrates the instrument so that direct reading two terminal measurements may be made in terms of DBMC. This is the most accurate method at any one calibration frequency.

a. Connect the signal to be measured directly, or through the Model CB-112 Input Cable (RF coaxial, type N), to the Main Unit SIGNAL INPUT Jack.

b. Ensure that the Main Unit front panel controls are positioned as follows:

CONTROL	POSITION
IMPULSE GEN DBMC Selector Switch.	53
Meter Function Selector Switch.	ZERO ADJ
Scan Mode Selector Switch.	MANUAL
Input Function Selector Switch.	CALIBRATE
Bandwidth Selector Switch.	WIDE
AFC Selector Switch.	OFF

c. Adjust the applicable Tuning Control until the corresponding Frequency Indicator Dial indicates the desired calibration frequency. (Refer to the applicable calibration chart, Figure 3-3 through 3-8).

d. Position the SIGNAL INPUT ATTEN (DB) Selector Switch to the desired setting listed in the applicable calibration chart.

e. Position the POWER Selector Switch to KLYSTRON ON.

f. Observe that the amber KLYSTRON ON Indicator illuminates.

g. Check that the front panel Indicating Meter pointer reads zero.

h. If the meter does not indicate zero, vary the ZERO ADJ Control until it does.

NOTE

Do not change the position of the ZERO ADJ Control during the remainder of this procedure.

i. Position the Meter Function Selector Switch to PEAK.

CAUTION

In order to insure maximum useful life of the impulse generator contacts, the IMP GEN PUSH TO OPR Pushbutton should be depressed only when required.

j. Depress the IMP GEN PUSH TO OPR Pushbutton and observe the Indicating Meter.

k. Adjust the GAIN Control until the meter indicates the desired reading listed in the applicable calibration chart.

l. Release the IMP GEN PUSH TO OPR Pushbutton to shut the impulse generator off.

NOTE

Do not readjust the GAIN Control during the remainder of this calibration procedure or while measurements at this calibration frequency are being made. If measurements are to be made at other frequencies, this complete procedure must be repeated for the new calibration frequency, and the GAIN Control may require readjusting.

m. For Two Terminal Broadband Noise measurements with the SIGNAL INPUT ATTEN (DB) Selector Switch positioned to 20, the instrument is now calibrated for a full scale sensitivity of approximately 53 DBMC. The sensitivity may be increased or decreased in 20 DB steps by changing the setting of the SIGNAL INPUT ATTEN (DB) Selector Switch.

n. The actual full scale sensitivity for each position of the SIGNAL INPUT ATTEN (DB) Selector Switch is listed in Figure 3-11.

o. The actual spectral intensity of the incoming signal in DBMC is the sum of the setting of the SIGNAL INPUT ATTEN (DB) Selector Switch, plus the meter indication (in DB), minus the impulse bandwidth factor as listed in Figure 3-11.

p. It must be noted that the sum of the SIGNAL INPUT ATTEN (DB) Selector Switch and the meter indication is somewhat greater than the 53 DBMC position of the IMPULSE GEN DBMC Selector Switch. This difference is due to the fact that the impulse bandwidth of the instrument, when the Bandwidth Selector Switch is positioned to WIDE, is greater than the standard bandwidth of one megacycle.

q. Position the Input Function Selector Switch to READ.

r. Adjust the SIGNAL INPUT ATTEN (DB) Selector Switch for an on-scale meter indication.

s. The setting of the SIGNAL INPUT ATTEN (DB) Selector Switch, plus the meter indication (in DB), minus the impulse bandwidth factor as listed in Figure 3-11 is the actual peak level (in DBMC) of the incoming broadband noise signal as it appears at the Main Unit SIGNAL INPUT Jack.

NOTE

To convert DBMC to microvolts per megacycle bandwidth, see Figure 3-9; to convert DBMC to microvolts per kilocycle bandwidth, see Figure 3-10.

t. After all direct reading measurements have been performed at this calibration frequency, and direct reading measurements are to be performed at other calibration frequencies, position the POWER Selector Switch to STANDBY, and repeat this complete procedure.

u. If the equipment is to be used for other types of measurements, position the POWER Selector Switch to STANDBY, and proceed to the applicable procedure.

v. If no other measurements are to be made, or the equipment is not to be used for an extended period of time, turn the equipment off by positioning the POWER Selector Switch to OFF.

3-29. Aural Slideback (Speaker or Phones) Method. Although the direct reading, calibrated method is used for the majority of measurements, the aural slideback method may prove more suitable when the incoming signal consists of pulses at an extremely slow repetition rate.

3-30. Varying the Main Unit front panel SLIDEBACK Control, changes the bias that is applied to a slideback detector. This produces a clipping

action, so that the detector passes only those signals that exceed the bias level; as a result, background noise is removed, and only the peaks of pulses are heard from the speaker or headset.

3-31. By increasing the slideback bias so that the peaks are barely audible, and by then matching this barely audible level with the calibrated output of the impulse generator, it is possible to accomplish accurate measurements of pulses which are sporadic or which are occurring at very low repetition rates. Proceed as follows:

a. Connect the signal to be measured directly, or through the Model CB-112 Input Cable (RF coaxial, type N), to the Main Unit SIGNAL INPUT Jack.

b. Ensure that the Main Unit front panel controls are positioned as follows:

CONTROL	POSITION
SLIDEBACK Control.	Counterclockwise
GAIN Control.	Mid position
VOLUME Control.	Clockwise
Meter Function Selector Switch. .	SLIDEBACK
Scan Mode Selector Switch.	MANUAL
Input Function Selector Switch. . .	READ
Bandwidth Selector Switch	WIDE
AFC Selector Switch.	OFF

c. Position the POWER Selector Switch to KLYSTRON ON.

d. Observe that the amber KLYSTRON ON Indicator illuminates.

e. Tune-in the incoming signal.

f. Adjust the SIGNAL INPUT ATTEN (DB) Selector Switch to the highest level which permits aural monitoring of the unknown incoming signal with the GAIN Control not positioned to either extreme.

NOTE

Adjusting the GAIN Control to near its minimum position may result in instrument overload, causing erroneous readings.

g. Rotate the SLIDEBACK Control clockwise, until the peaks of the unknown incoming signal are barely audible.

NOTE

After adjusting the GAIN and SLIDEBACK Controls until the noise is at the threshold of audibility, do not readjust these controls during the remainder of this procedure.

h. Note the setting of the SIGNAL INPUT ATTEN (DB) Selector Switch.

i. Position the Input Function Selector Switch to CALIBRATE.

j. Depress the IMP GEN PUSH TO OPR Pushbutton and listen for an audible tone.

k. Adjust the SIGNAL INPUT ATTEN (DB) Selector Switch and the IMPULSE GEN DBMC Selector Switch until the threshold of audibility level, as heard in step (g), is attained.

l. Release the IMP GEN PUSH TO OPR Pushbutton to shut the impulse generator off.

m. If the SIGNAL INPUT ATTEN (DB) Selector Switch was not changed in step (k), the position of the IMPULSE GEN DBMC Selector Switch approximates the level in DBMC of the unknown incoming broadband noise signal. Since the insertion loss of the SIGNAL INPUT ATTEN (DB) Selector Switch is the same for both unknown and calibrating signals, its setting need not be considered.

NOTE

To convert DBMC to microvolts per megacycle bandwidth, see Figure 3-9; to convert DBMC to microvolts per kilocycle bandwidth, see Figure 3-10.

n. If the setting of the SIGNAL INPUT ATTEN (DB) Selector Switch was decreased in step (k), the level of the unknown incoming signal must be higher than the maximum 53 DBMC output of the impulse generator. In this case, the change in the SIGNAL INPUT ATTEN (DB) Selector Switch setting (in DB) between steps (g) and (k) must be added to the IMPULSE GEN DBMC Selector Switch setting to obtain the level in DBMC of the unknown incoming broadband noise signal.

o. If the setting of the SIGNAL INPUT ATTEN (DB) Selector Switch was increased in step (k), the level of the unknown incoming signal must be lower than the minimum 42 DBMC output of the impulse generator. In this case, the change in the SIGNAL INPUT ATTEN (DB) Selector Switch setting (in DB) between steps (g) and (k) must be subtracted from the IMPULSE GEN DBMC Selector Switch setting to obtain the level in DBMC of the unknown incoming broadband noise signal.

p. After all aural slideback measurements have been performed at this frequency, and measurements are to be performed at other frequencies, position the POWER Selector Switch to STANDBY, and repeat this complete procedure.

q. If the equipment is to be used for other types of measurements, position the POWER Selector Switch to STANDBY, and proceed to the applicable procedure.

r. If no other measurements are to be made, or the equipment is not to be used for an extended period of time, turn the equipment off by positioning the POWER Selector Switch to OFF.

3-32. RADIATED CW MEASUREMENTS. Radiated CW measurements are performed using an antenna as the pickup device. The units of measurement are voltage per meter, which takes into account the antenna's reception characteristics.

3-33. To perform Radiated CW measurements, proceed as follows:

a. Interconnect the applicable antenna to the equipment. (See Figure 2-1 for antenna interconnections, and refer to paragraphs 3-34 through 3-36 for antenna operation.)

b. Perform the Two Terminal CW measurement procedures, and note the two terminal RF voltage. (Refer to paragraphs 3-24 and 3-26.)

c. Add the antenna factor to the two terminal RF voltage in order to determine the field strength in terms of voltage per meter. (See Figures 3-14 through 3-16 to determine the antenna factor for the antenna in use, and refer to paragraphs 3-37 through 3-39 for use of the antenna factor.)

NOTE

To convert field strength in microvolts per meter to power density in watts per square meter, see Figure 3-12; to convert field strength in DB above 1 uv per meter to power density in DBM per square meter, see Figure 3-13.

3-34. Antenna Operation. To perform radiated measurements, use is made of the antennas listed in Table 3-3.

TABLE 3-3. ANTENNAS

FREQ. RANGE	ANTENNA MODEL NO.	ANTENNA TYPE	USED WITH REFLECTOR	CONTAINED IN KIT	COUPLED WITH	ANTENNA FACTOR CHART
1 to 10 Gc/s	LPA-112	Pyramidal Log Periodic	AT-112	KT-112	CB-112	Fig.3-14.
1 to 10 Gc/s	BB-112	Broadband Omnidirectional	None	BB-112	CB-112	None
6 to 10 Gc/s	HF-112	Horn Feed, High Gain	AT-112	KT-112	CB-112	Fig. 3-15.
10 to 15 Gc/s	HF-112-5	Waveguide Horn Feed	AT-112 with Bracket BR-112-5	KT-112-5	FW-112-5	Fig. 3-16.
15 to 22 Gc/s	LGA-112-6A	Waveguide Horn Feed, Low Gain	AT-112	KT-112-6A	FW-112-6	
15 to 22 Gc/s	HGA-112-6B	Waveguide Horn Feed, High Gain	Attached to HGA-112-6B	KT-112-6B	FW-112-6	

3-35. The antenna should be mounted on the Model TP-112 Tripod, and interconnected as illustrated in Figure 2-1. Note that the entire antenna assembly can be rotated to achieve the desired polarization. By utilizing the dial on the back of the antenna, it is feasible to accurately measure relative polarization angles.

3-36. Some radiated measurements are made outdoors and at a location remote from the test sample. While atmospheric noise will inevitably be present to some extent, other ambient noises should be eliminated as much as possible. This is accomplished by selecting a site (preferably on a hill or over water) that is open and level. Reception over water is normally more noise-free than over land. The selected site should have a minimum of trees and underbrush, and be at least 100 feet from any possible source of man-made interference (power lines, telephone lines, industrial buildings, etc.). Undesirable results may be expected if the instrument is operated under, or close to, steel bridges, underpasses, metal fences, iron-frame buildings, or any other projection displaying conductive or inductive properties.

3-37. Use of Antenna Factor. To illustrate the use of the antenna factor to convert two terminal RF voltage to field strength, assume that a two terminal reading of 40 DB above 1 uv (100 uv) has been obtained on an incoming signal of 5 Gc/s while using the Model LPA-112 log periodic antenna.

3-38. Figures 3-14 through 3-16 are graphs showing the antenna factor in DB as a function of frequency for the various antennas. All pertinent considerations are included in this single factor; antenna gain, cable and waveguide losses, and conversion to open circuit voltage.

3-39. Consultation of Figure 3-14 discloses the antenna factor of the Model LPA-112 at 5 Gc/s to be 23.6 DB. Simply add this 23.6 DB antenna factor to the two terminal reading of 40 DB above 1 uv to obtain the actual field strength of 63.6 DB above 1 uv per meter.

3-40. RADIATED BROADBAND NOISE MEASUREMENTS. Radiated Broadband Noise measurements are performed using an antenna as the pickup device. The units of measurement are voltage per unit bandwidth per meter, which takes into account the antenna's reception characteristics.

3-41. To perform Radiated Broadband Noise measurements, proceed as follows:

a. Interconnect the applicable antenna to the equipment. (See Figure 2-1 for antenna interconnections, and refer to paragraphs 3-34 through 3-36 for antenna operation.)

b. Perform the Two Terminal Broadband Noise measurement procedures, and note the two terminal RF voltage, including the impulse bandwidth factor. (Refer to paragraphs 3-27 through 3-31.)

c. Add the antenna factor to the two terminal RF voltage in order to determine the field strength in terms of voltage per unit bandwidth per meter. (See Figures 3-14 through 3-16 to determine the antenna factor for the antenna in use, and refer to paragraphs 3-37 through 3-39 for use of the antenna factor.)

3-42. BANDWIDTH SWITCHING. The Bandwidth Selector Switch is usually left in the WIDE position. However, there are several instances when it may be desirable to use the NARROW position.

3-43. If it has been established that the signal to be measured is of a narrow band nature, it is possible to obtain increased signal to noise ratio by switching to the NARROW bandwidth position. The amount of noise, both externally and internally generated will be reduced, by narrowing the bandwidth. However, if the signal has a spectrum that is wider than the 600 Kc/s narrow bandwidth of the instrument, a portion of the desired signal will be lost when using the NARROW position.

3-44. To determine the width of the spectrum of an unknown signal, the Bandwidth Selector Switch may be used to advantage. For a broadband noise signal with a uniform spectrum across the entire 3 Mc/s wide bandwidth, switching to the 600 Kc/s narrow bandwidth will result in a 12 to 14 DB decrease in the PEAK indication. If the amount of decrease is much less than that, the incoming signal spectrum must not be uniformly distrubuted across the wide bandwidth, and should be considered a narrow band signal.

3-45. FREQUENCY TUNING. Three methods may be employed to drive the Tuning Units; FULL SCAN, MANUAL, and SECTOR SCAN. The FULL SCAN and SECTOR SCAN Modes of operation have been described in the Section 2 Installation Checks, and the function of all the controls has been described in Table 3-1. The operating procedures previously discussed employ the MANUAL Mode of frequency tuning.

3-46. Motor drive tuning is used to advantage when X-Y plotting is employed. The FULL SCAN Mode is used when a plot of intensity vs frequency is required over the entire range of each freqency band. The SECTOR SCAN Mode is used when a certain portion of the frequency band is to be monitored over an extended period of time.

3-47. For information concerning X-Y plotting, refer to the Series 112 X-Y Recording Supplement.

CALIBRATION CHART

FOR

TUNING UNIT T-1/NF-112-F

(SERIAL NO. 20)

Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust Gain for Meter indication in DB of:
0.9		
1.0	40	~~30.0~~ 27.0
1.1	40	29.5
1.2	40	29.0
1.3	40	30.0
1.4	40	31.5
1.5	40	31.0
1.6	40	32.0
1.7	40	33.0
1.8	40	33.0
1.9	40	32.5
2.0	40	31.5
2.1		

NOTE

Bandwidth Selector Switch must be positioned to WIDE, and IMPULSE GEN DBMC Selector Switch must be positioned to 53.

Figure 3-3. Tuning Unit T-1 Calibration Chart

CALIBRATION CHART

FOR

TUNING UNIT T-2/NF-112-F

(SERIAL NO. 20)

Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust GAIN for Meter Indication in DB of:	Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust GAIN for Meter Indication in DB of:
2.0	40	31.5	3.1	40	31.0
2.1	40	30.5	3.2	40	31.5
2.2	40	29.5	3.3	40	31.5
2.3	40	28.5	3.4	40	31.5
2.4	40	28.5	3.5	40	31.5
2.5	40	28.0	3.6	40	31.0
2.6	40	28.0	3.7	40	31.5
2.7	40	27.5	3.8	40	31.5
2.8	40	29.0	3.9	40	31.0
2.9	40	28.5	4.0	40	31.0
3.0	40	30.0			

NOTE

Bandwidth Selector Switch must be positioned to WIDE, and IMPULSE GEN DBMC Selector Switch must be positioned to 53.

Figure 3-4. Tuning Unit T-2 Calibration Chart

CALIBRATION CHART

FOR

TUNING UNIT T-3/NF-112-F

(SERIAL NO. 20)

Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust GAIN for Meter Indication in DB of:	Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust GAIN for Meter Indication in DB of:
4.0	40	31.5	5.6	40	28.0
4.1	40	33.0	5.7	40	27.5
4.2	40	32.0	5.8	40	29.5
4.3	40	32.5	5.9	40	28.5
4.4	40	31.5	6.0	40	30.0
4.5	40	32.0	6.1	40	30.0
4.6	40	33.0	6.2	40	29.5
4.7	40	31.5	6.3	40	30.5
4.8	40	32.0	6.4	40	30.5
4.9	40	31.5	6.5	40	29.5
5.0	40	31.5	6.6	40	30.5
5.1	40	32.0	6.7	40	31.0
5.2	40	31.0	6.8	40	30.5
5.3	40	30.5	6.9	40	29.0
5.4	40	31.0	7.0	40	30.0
5.5	40	29.0	7.1		

NOTE

Bandwidth Selector Switch must be positioned to WIDE, and IMPULSE GEN DBMC must be positioned to 53.

Figure 3-5. Tuning Unit T-3 Calibration Chart

CALIBRATION CHART

FOR

TUNING UNIT T-4/NF-112-F

(SERIAL NO. 20)

Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust GAIN for Meter Indication in DB of:	Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust GAIN for Meter Indication in DB of:
7.0	40	30.5	8.6	40	24.0
7.1	40	31.0	8.7	40	23.0
7.2	40	28.5	8.8	40	22.0
7.3	40	30.5	8.9	40	23.5
7.4	40	29.0	9.0	40	23.5
7.5	40	29.0	9.1	40	26.0
7.6	40	30.5	9.2	40	23.5
7.7	40	31.5	9.3	40	25.0
7.8	40	30.0	9.4	40	21.5
7.9	40	28.5	9.5	40	22.5
8.0	40	~~25.5~~ 23.0	9.6	40	22.0
8.1	40	27.5	9.7	40	21.0
8.2	40	26.5	9.8	40	21.5
8.3	40	26.0	9.9	40	20.0
8.4	40	23.5	10.0	40	22.5
8.5	40	23.0			

NOTE

Bandwidth Selector Switch must be positioned to WIDE, and IMPULSE GEN DBMC Selector Switch must be positioned to 53.

Figure 3-6. Tuning Unit T-4 Calibration Chart

CALIBRATION CHART

FOR

TUNING UNIT T-5/NF-112-F

(SERIAL NO. _____)

Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust GAIN for Meter indication in DB of:
10.0		
10.5		
11.0		
11.5		
12.0		
12.5		
13.0		
13.5		
14.0		
14.5		
15.0		

NOTE

Bandwidth Selector Switch must be positioned to WIDE, and IMPULSE GEN DBMC Selector Switch must be positioned to 53.

Figure 3-7. Tuning Unit T-5 Calibration Chart.

CALIBRATION CHART

FOR

TUNING UNIT T-6/NF-112-F

(SERIAL NO. _____)

Adjust Frequency Indicator Dial in Gc/s to:	Set SIGNAL INPUT ATTEN (DB) to:	Adjust GAIN for Meter indication in DB of:
15.0		
16.0		
17.0		
18.0		
19.0		
20.0		
21.0		
22.0		

NOTE

Bandwidth Selector Switch must be positioned to WIDE, and IMPULSE GEN DBMC Selector Switch must be positioned to 53.

Figure 3-8. Tuning Unit T-6 Calibration Chart.

DB Above 1 Microvolt
to
Microvolts

or

DB Above 1 Microvolt Per Megacycle Bandwidth (DBMC)
to
Microvolts Per Megacycle Bandwidth

Total DB or DBMC	20	30	40	50	60	70	80	90	100	110
0	10.0	31.6	100	316	1000	3160	10000	31600	100000	316000
1	11.2	35.5	112	355	1120	3550	11200	35500	112000	355000
2	12.6	39.8	126	398	1260	3980	12600	39800	126000	398000
3	14.1	44.7	141	447	1410	4470	14100	44700	141000	447000
4	15.8	50.1	158	501	1580	5010	15800	50100	158000	501000
5	17.8	56.2	178	562	1780	5620	17800	56200	178000	562000
6	20.0	63.1	200	631	2000	6310	20000	63100	200000	631000
7	22.4	70.8	224	708	2240	7080	22400	70800	224000	708000
8	25.1	79.4	251	794	2510	7940	25100	79400	251000	794000
9	28.2	89.1	282	891	2820	8910	28200	89100	282000	891000
10	31.6	100.0	316	1000	3160	10000	31600	100000	316000	1000000

Microvolts

or

Microvolts Per Megacycle Bandwidth

FIGURE 3-9 Conversion Chart
(DB or DBMC to uv or uv/MC).

DB Above 1 Microvolt Per Megacycle (DBMC)

to

Microvolts Per Kilocycle Bandwidth

TOTAL DBMC	20	30	40	50	60	70	80	90	100	110
0	.0100	.0316	.100	.316	1.00	3.16	10.0	31.6	100	316
1	.0112	.0355	.112	.355	1.12	3.55	11.2	35.5	112	355
2	.0126	.0398	.126	.398	1.26	3.98	12.6	39.8	126	398
3	.0141	.0447	.141	.447	1.41	4.47	14.1	44.7	141	447
4	.0158	.0501	.158	.501	1.58	5.01	15.8	50.1	158	501
5	.0178	.0562	.178	.562	1.78	5.62	17.8	56.2	178	562
6	.0200	.0631	.200	.631	2.00	6.31	20.0	63.1	200	631
7	.0224	.0708	.224	.708	2.24	7.08	22.4	70.8	224	708
8	.0251	.0794	.251	.794	2.51	7.94	25.1	79.4	251	794
9	.0282	.0891	.282	.891	2.82	8.91	28.2	89.1	282	891
10	.0316	.1000	.316	1.000	3.16	10.00	31.6	100.0	316	1000

Microvolts Per Kilocycle Bandwidth

FIGURE 3-10, Conversion Chart (DBMC to DBKC).

IMPULSE BANDWIDTH FACTOR

AND

BROADBAND NOISE

FULL SCALE SENSITIVITY

FOR

MAIN UNIT MODEL NF-112-F

(SERIAL NO._____)

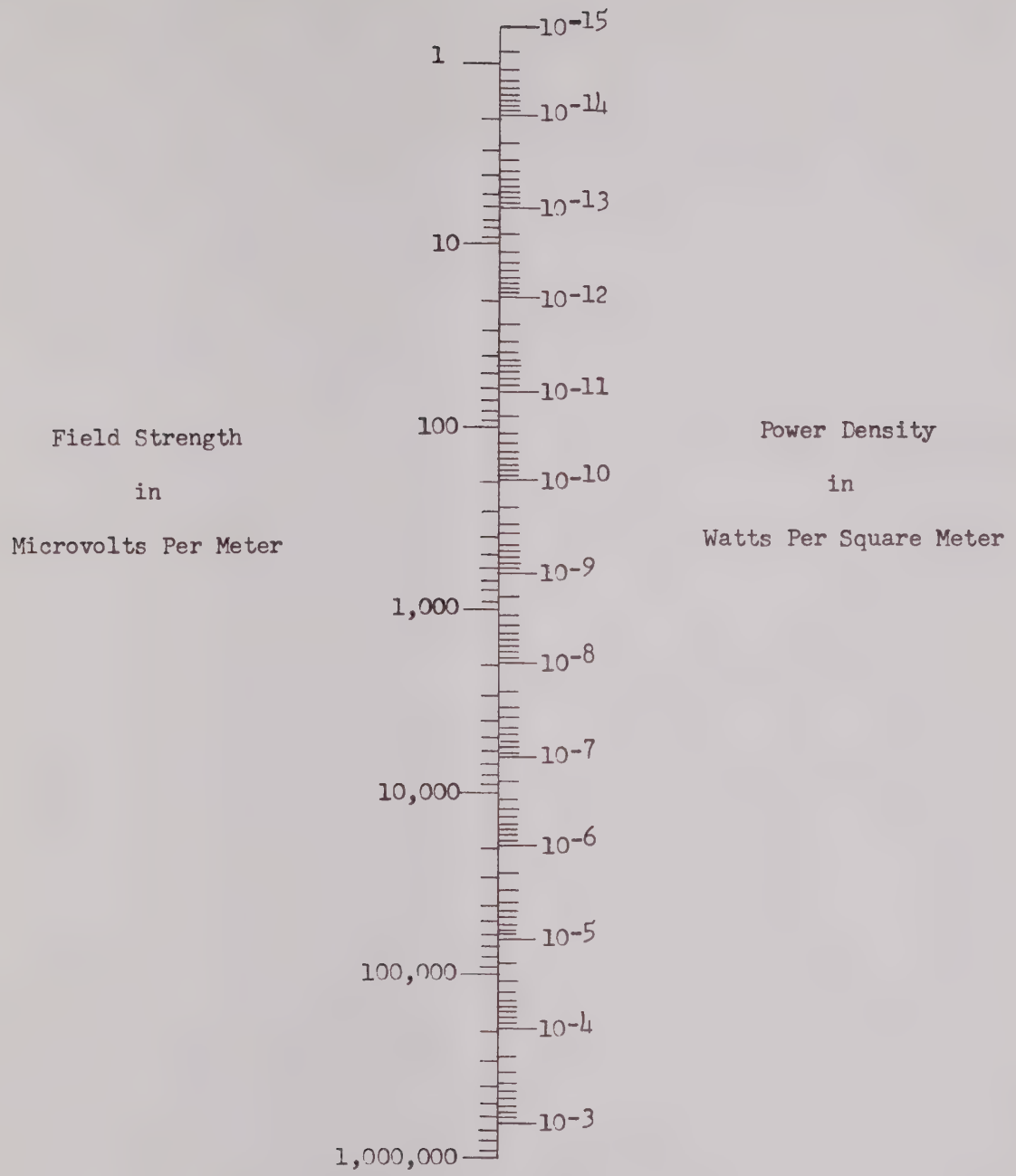
IMPULSE BANDWIDTH FACTOR	12.0 DB

SIGNAL INPUT ATTEN (DB) Selector Switch	Full Scale Sensitivity (Broadband Noise)
0 DB	28 DBMC
20 DB	48 DBMC
40 DB	68 DBMC
60 DB	88 DBMC
80 DB	108 DBMC

NOTE

The actual spectral intensity of the incoming broadband noise signal in DBMC is the sum of the setting of the SIGNAL INPUT ATTEN (DB) Selector Switch, plus the meter indication (in DB), minus the above impulse bandwidth factor.

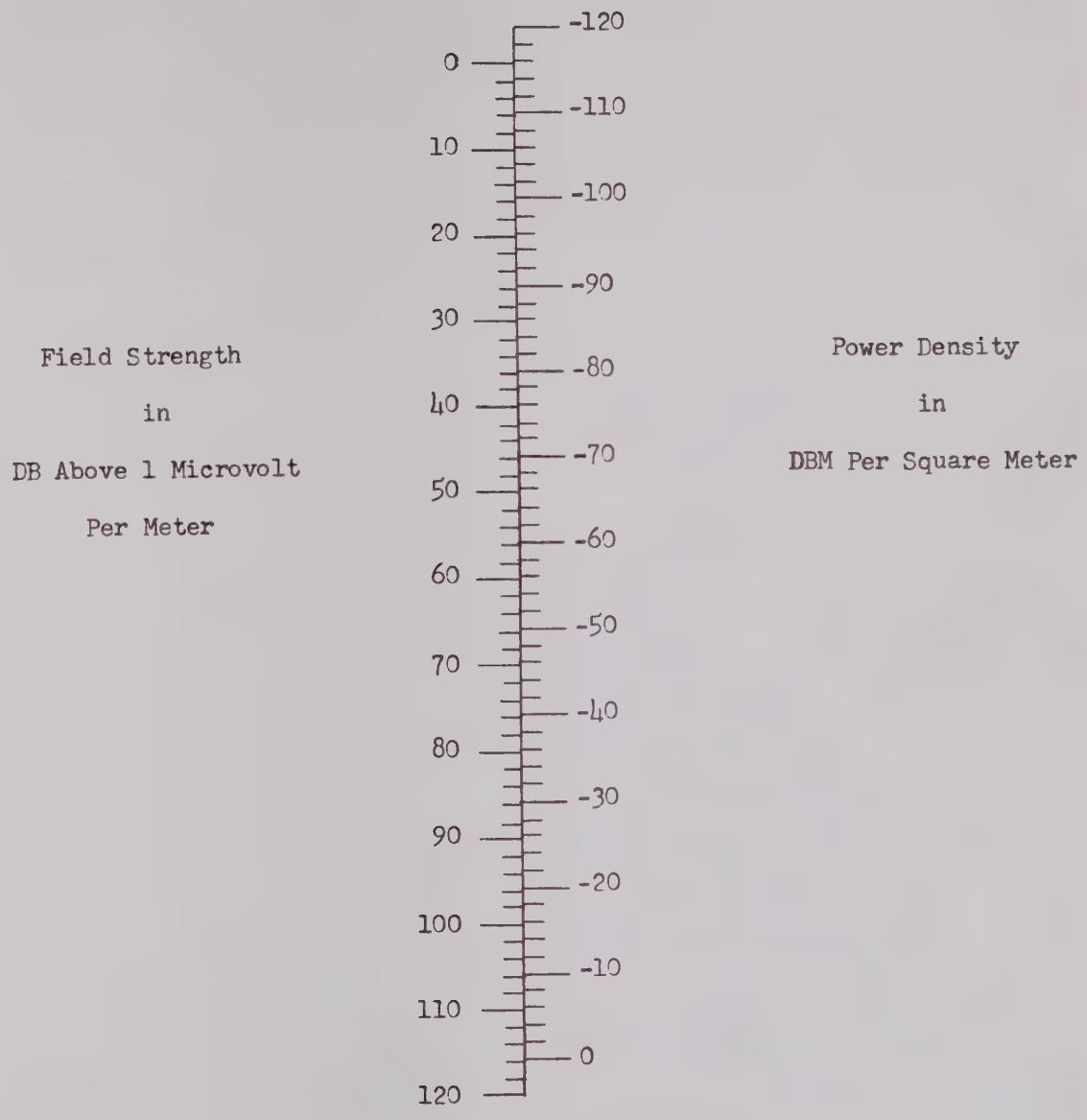
Figure 3-11. Broadband Noise Calibration Chart.



FIELD STRENGTH to POWER DENSITY

-- Microvolts Per Meter to Watts Per Square Meter

Figure 3-12. Conversion Chart (uv to w/m^2).



FIELD STRENGTH to POWER DENSITY

-- DB Above 1 Microvolt Per Meter to DBM Per Square Meter

Figure 3-13 Conversion Chart (DB above 1 uv to DBM/m^2).

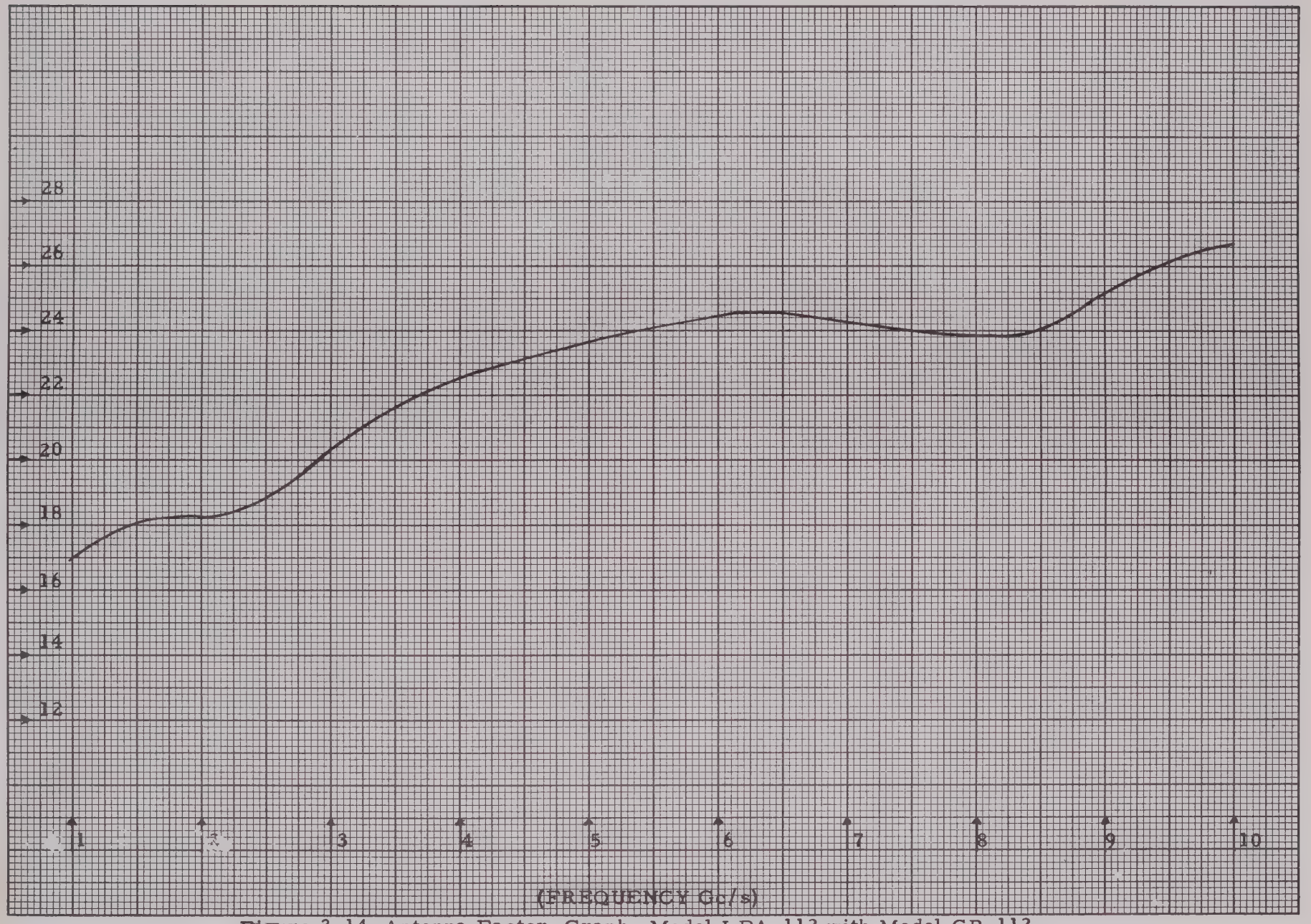


Figure 3-14 Antenna Factor Graph, Model LPA-112 with Model CB-112.

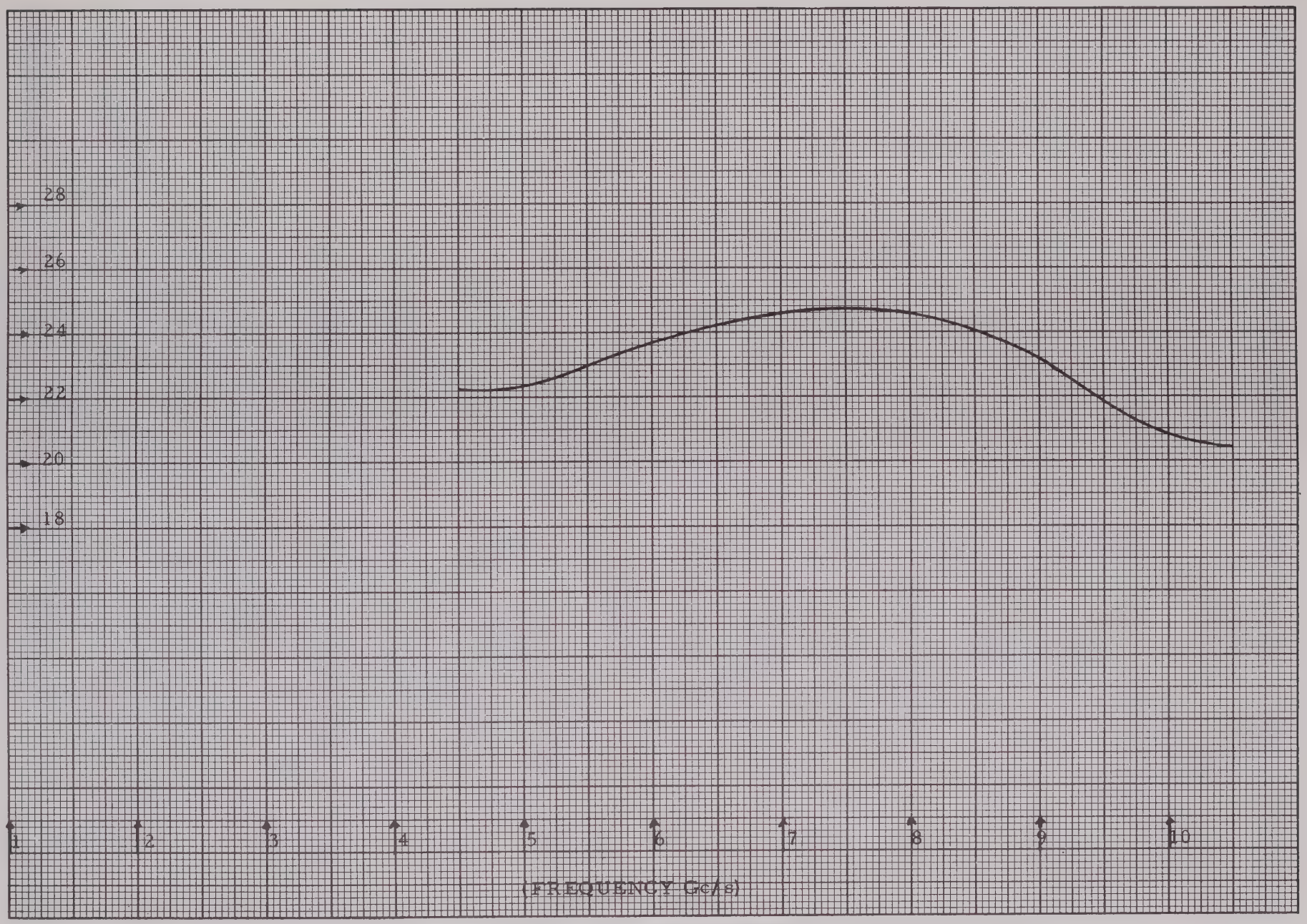


Figure 3-15. Antenna Factor Graph, Model HF-112 with Model CB-112.

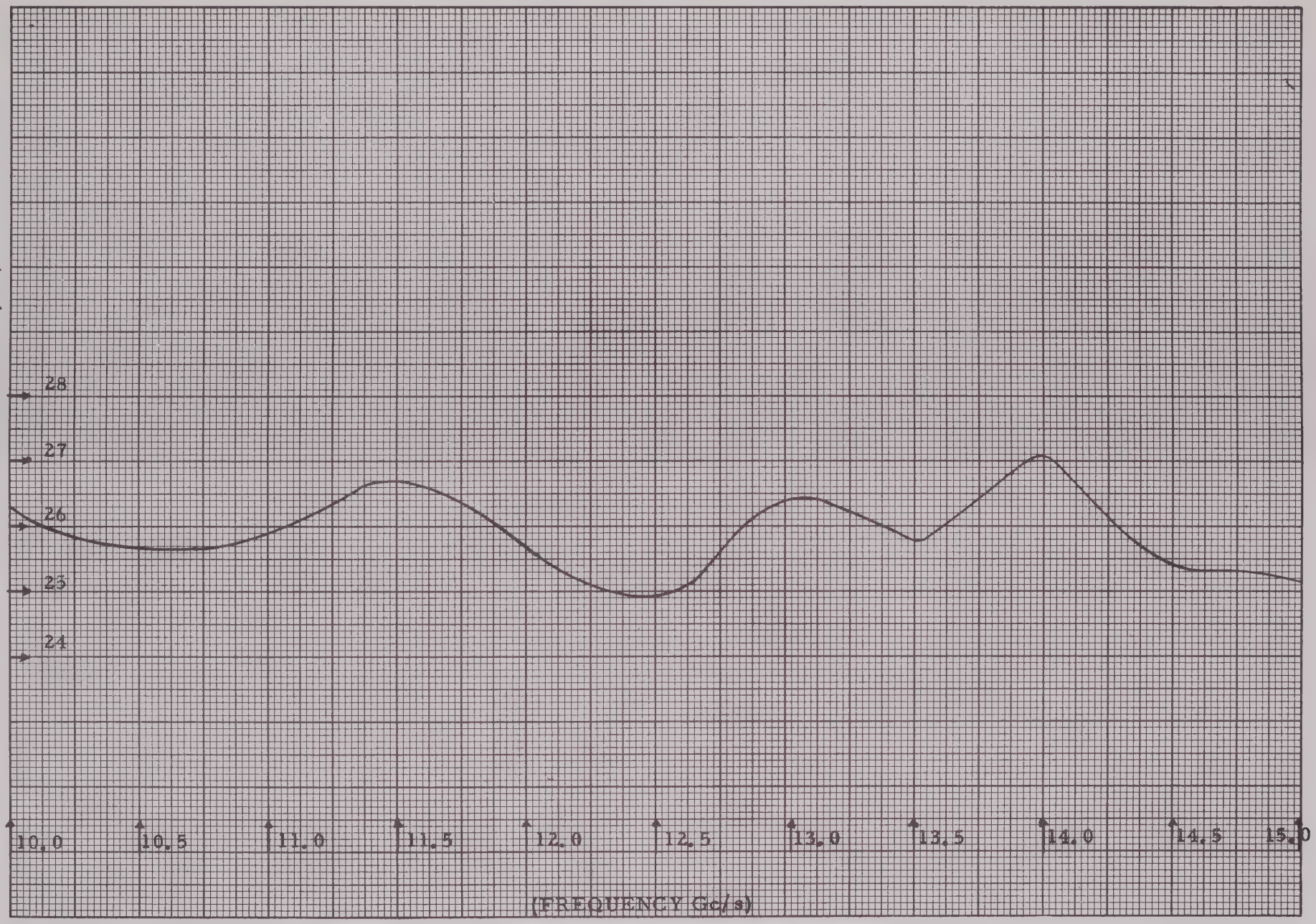
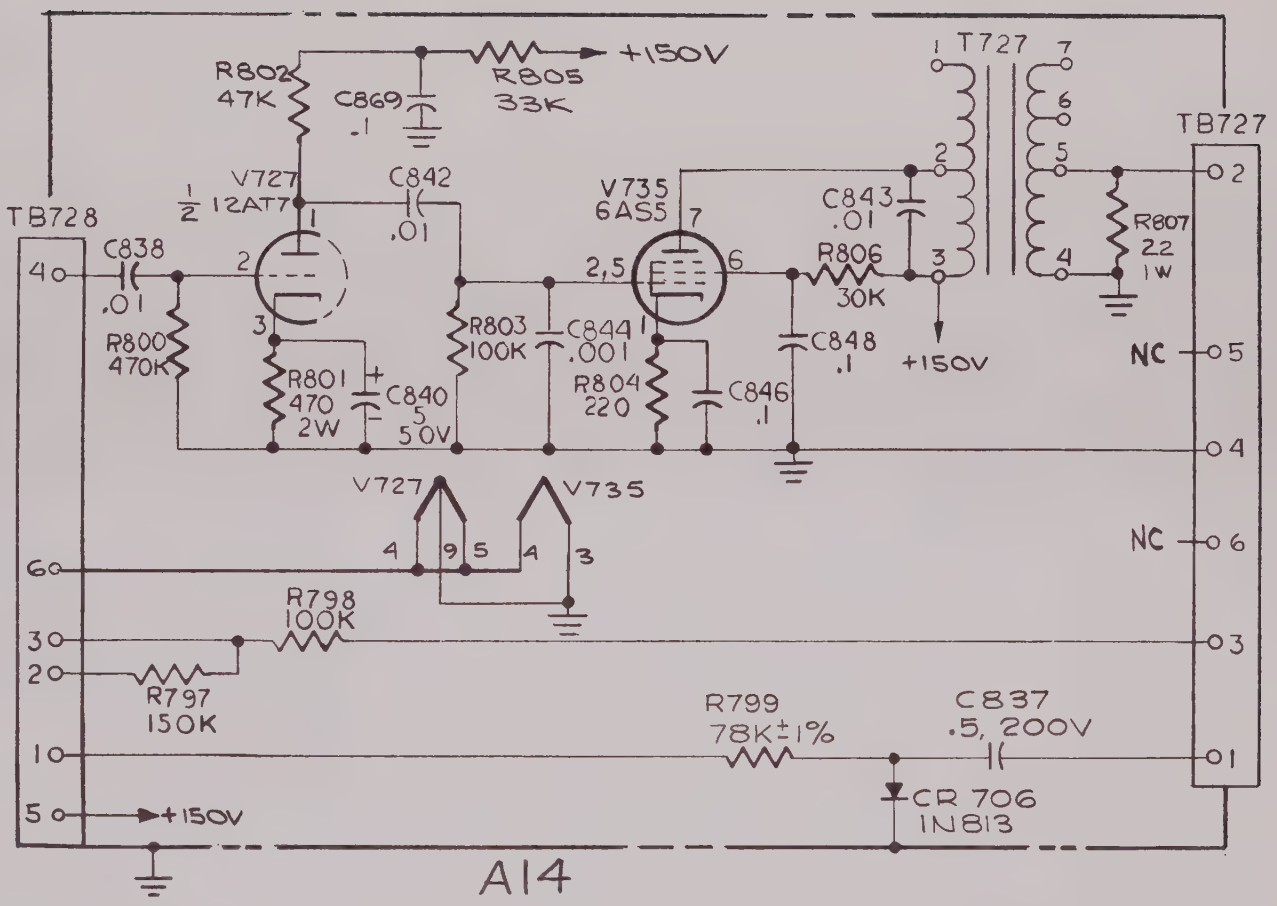


Figure 3-16. Antenna Factor Graph, Model HF-112-5 with Model FW-112-5

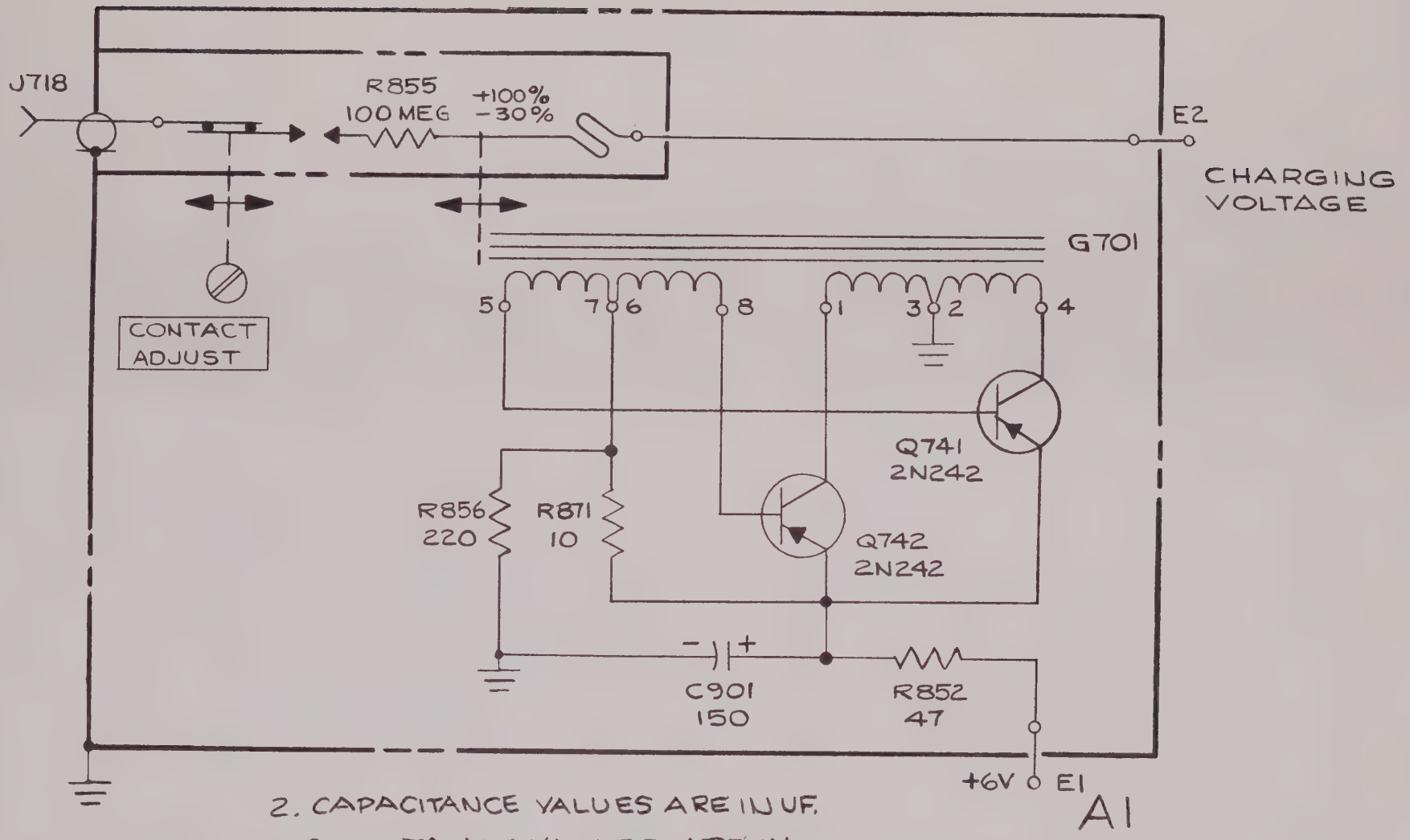
106-0217



2. CAPACITANCE VALUES ARE IN UF.
1. RESISTANCE VALUES ARE IN OHMS ±5%, 1/2W.

Schematic Diagram, Audio Amp (A14)

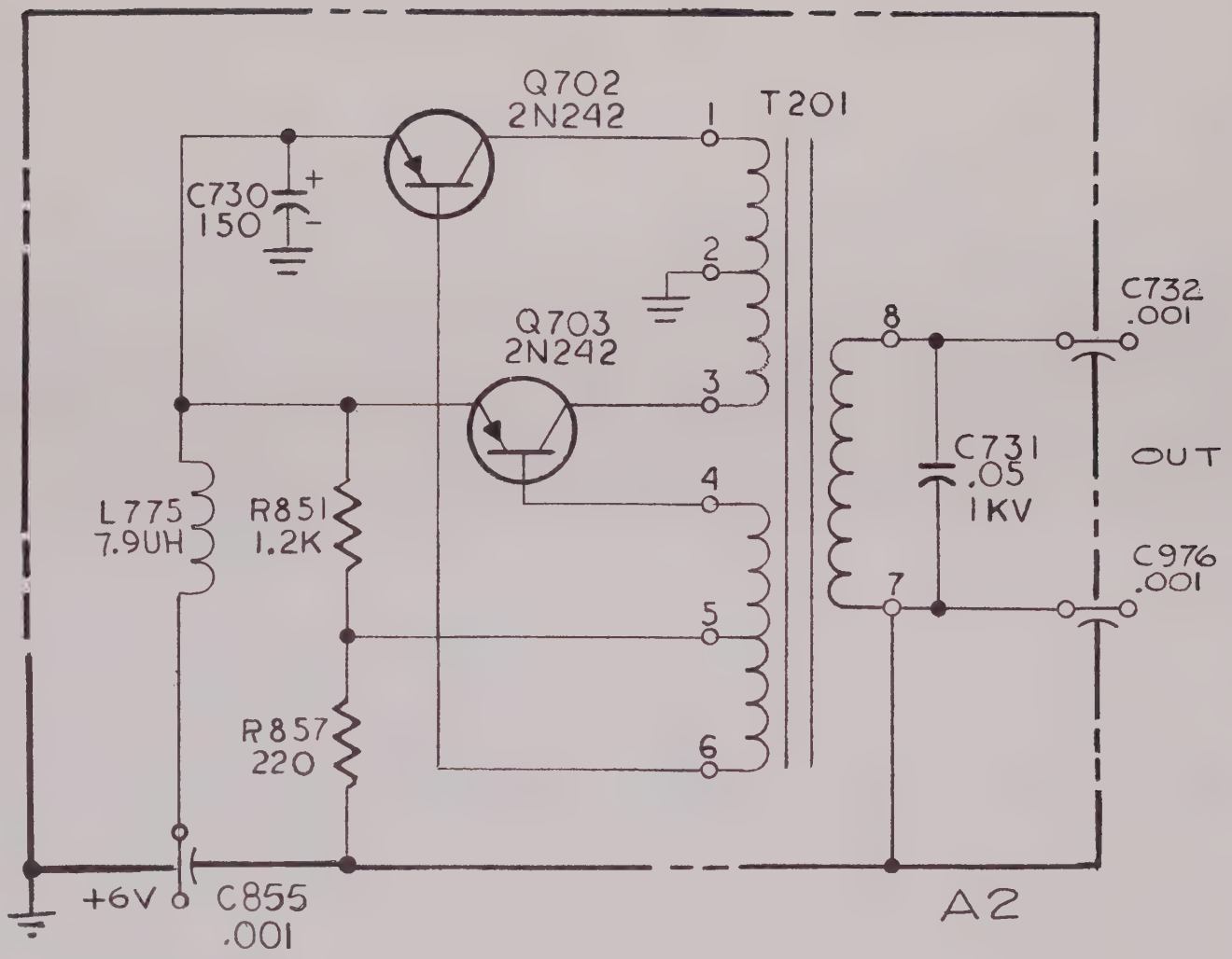
106-0218



2. CAPACITANCE VALUES ARE IN UF.

1. RESISTANCE VALUES ARE IN OHMS ±5%, 1/2 W.

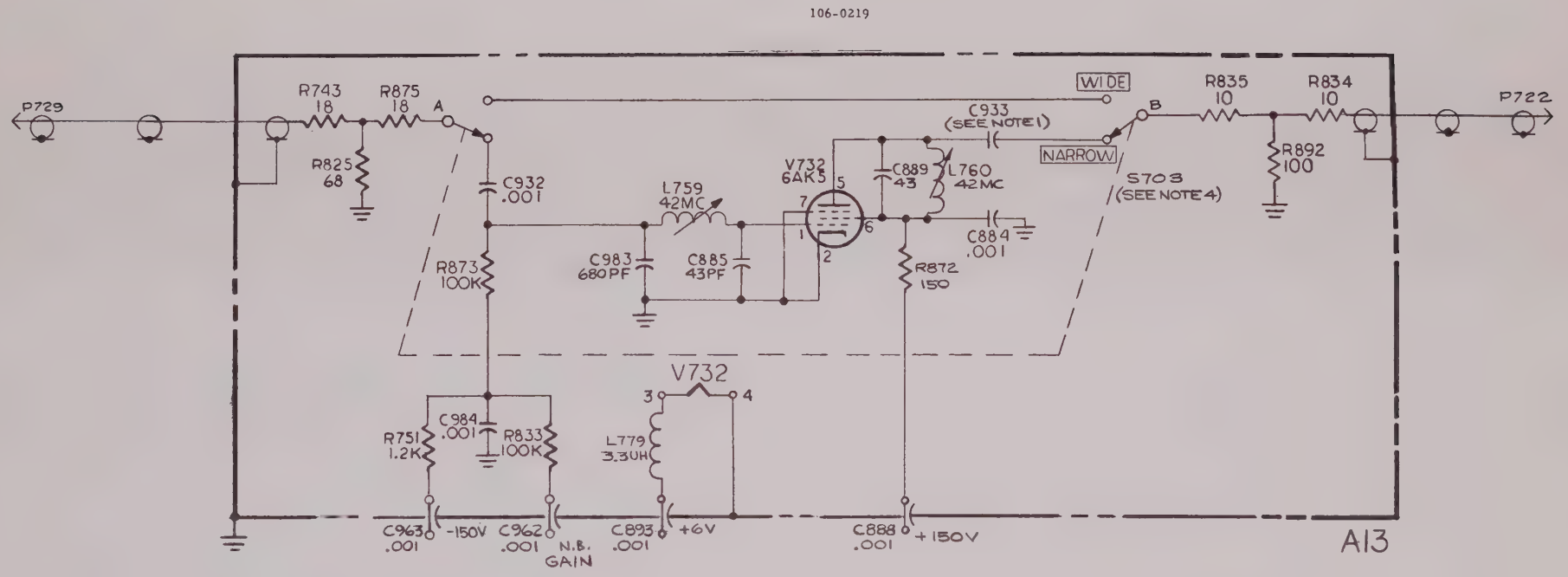
Schematic Diagram, Impulse Generator Driver (A1)



2. CAPACITANCE VALUES ARE IN UF.

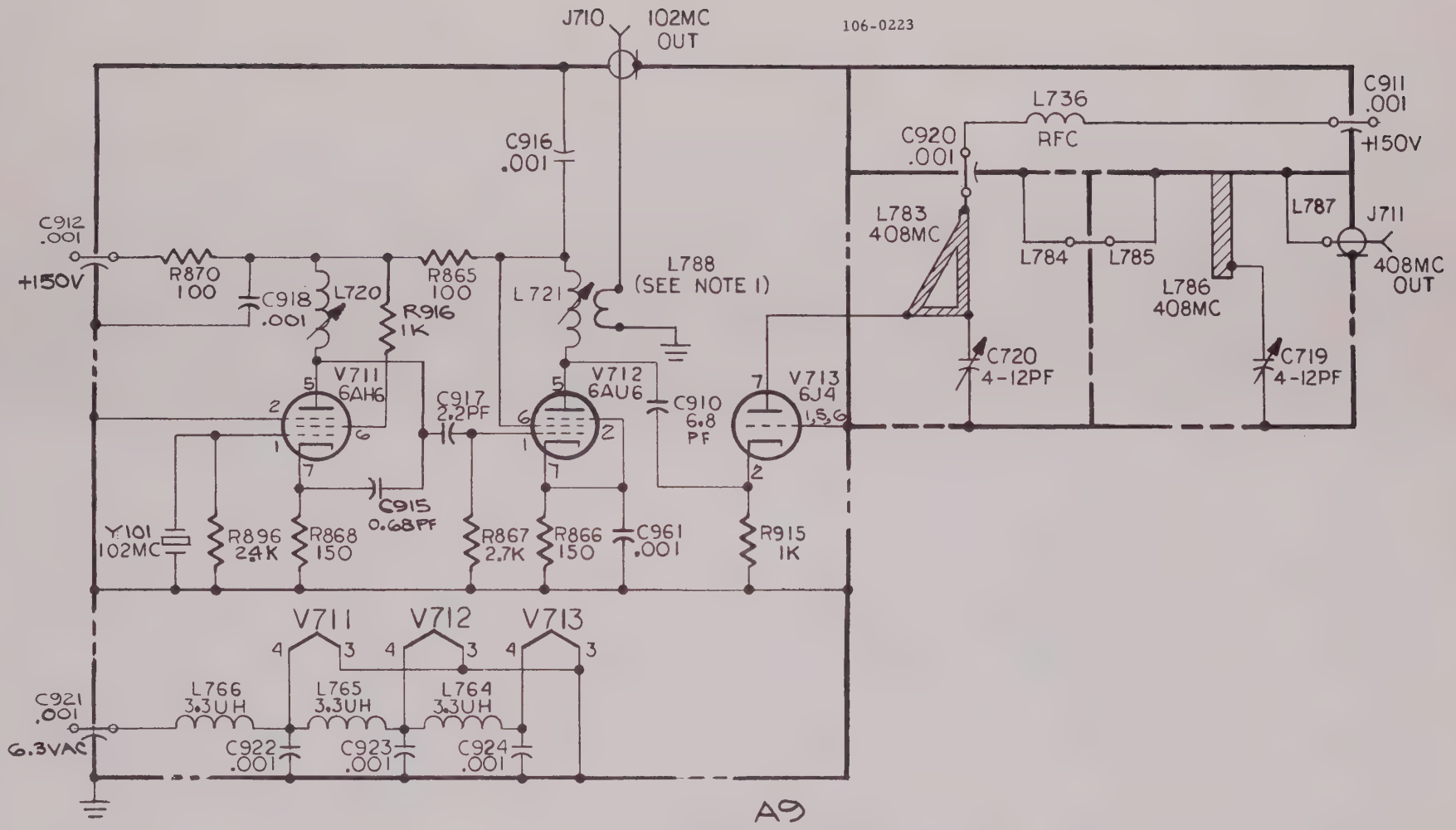
1. RESISTANCE VALUES ARE IN OHMS ±5%, 1/2W.

Schematic Diagram, Impulse Generator Charging Voltage (A2)



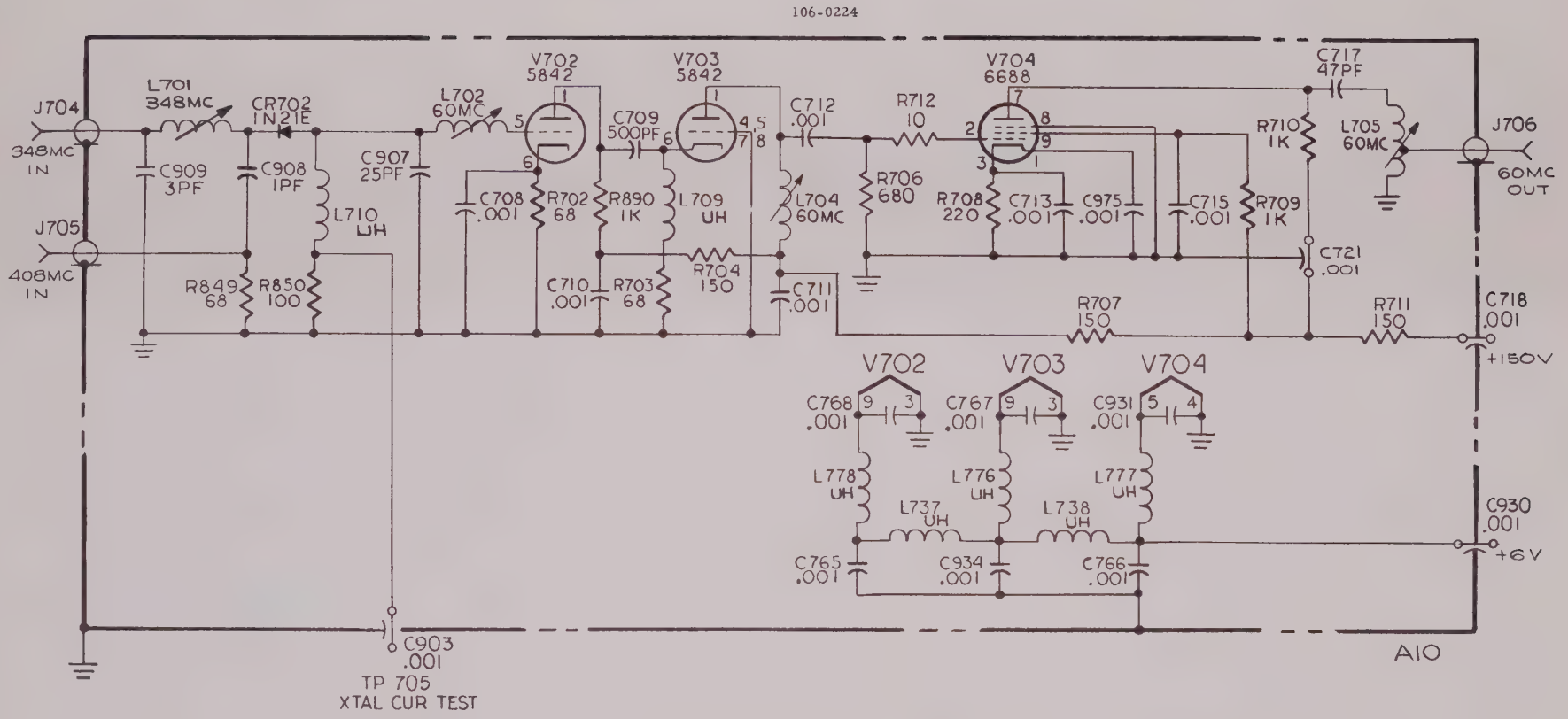
4. ON NF-112, -M, -X WIDE IS FULLY CLOCKWISE.
   ON NF-112-F NARROW IS FULLY CLOCKWISE.
3. CAPACITANCE VALUES ARE IN UF.
2. RESISTANCE VALUES ARE IN OHMS ±5%, 1/2W.
1. FACTORY SELECTED: 2 TO 10 PF.

Schematic Diagram, Bandwidth Control (A13)



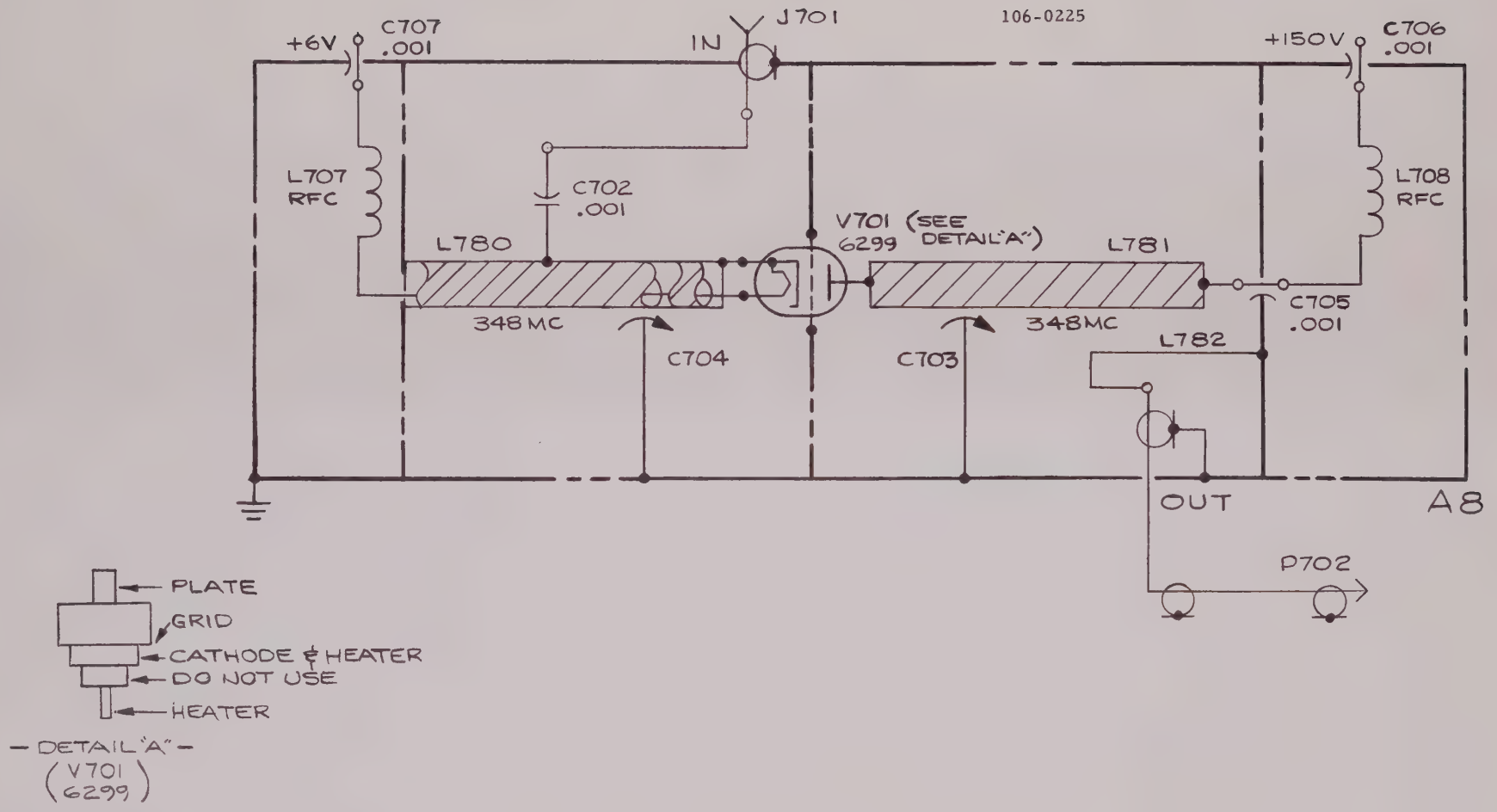
3. CAPACITANCE VALUES ARE IN U F.
2. RESISTANCE VALUES ARE IN OHMS ±5% 1/2W.
1. COUPLING LOOP L788 TO BE INSTALLED AT ASSY.

Schematic Diagram, Crystal Local Oscillator (A9)



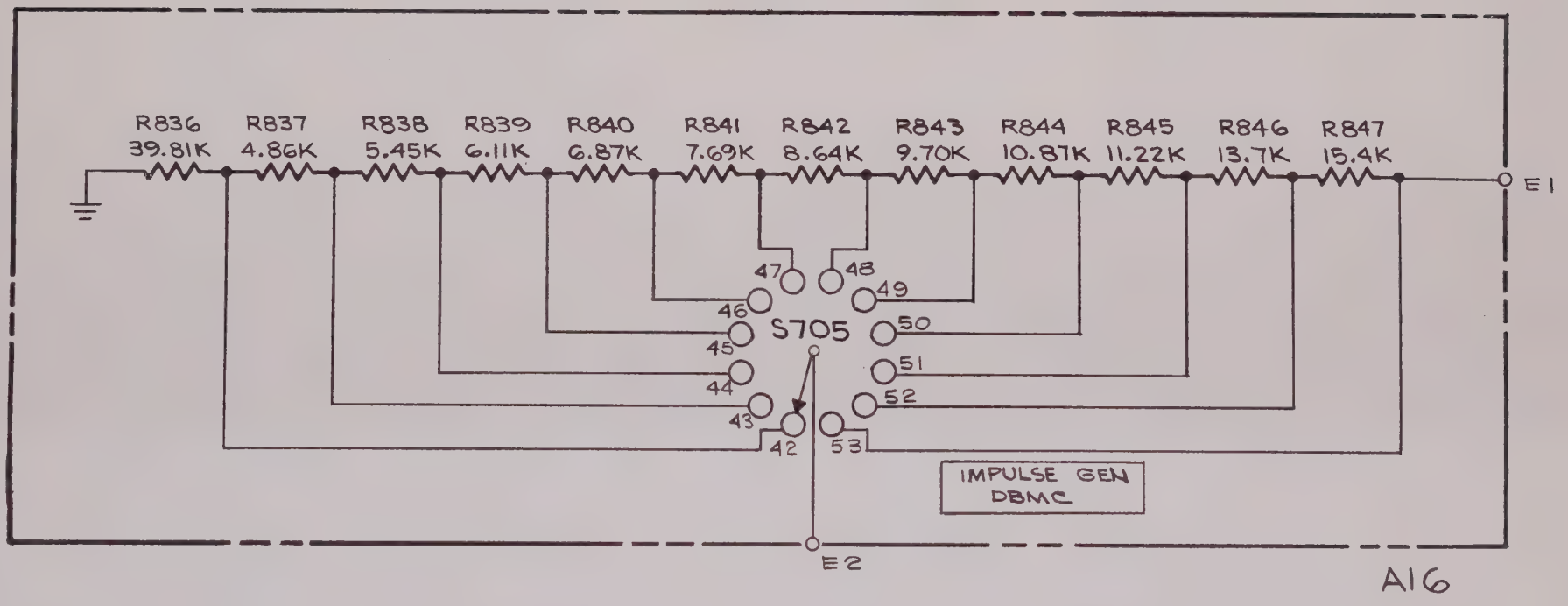
2. CAPACITANCE VALUES ARE IN UF.
1. RESISTANCE VALUES ARE IN OHMS ±5%, 1/2W.

Schematic Diagram, 60 MC Mixer Preamp (A10)



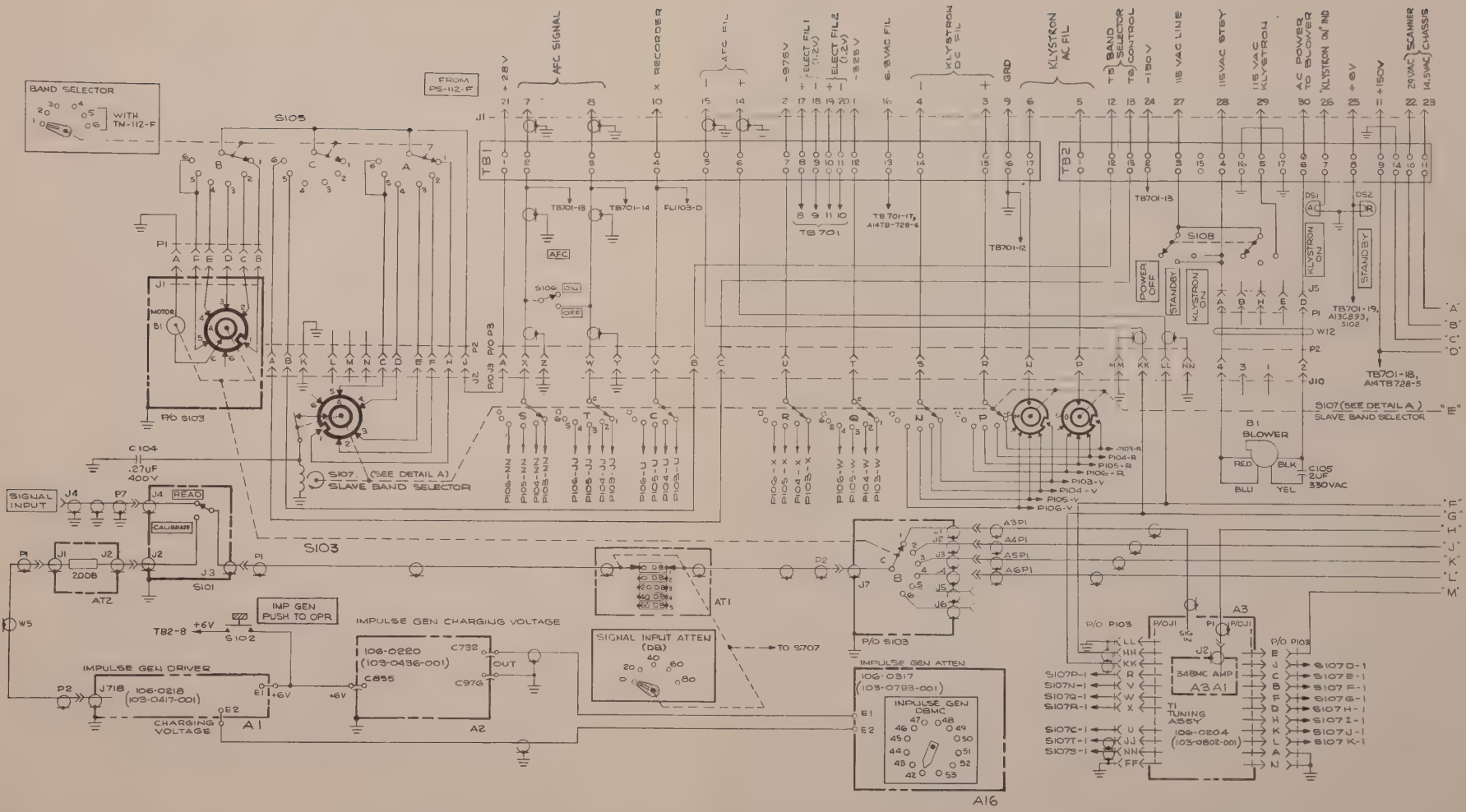
1. CAPACITANCE VALUES ARE IN UF.

Schematic Diagram, 348 MC Postamp (A8)

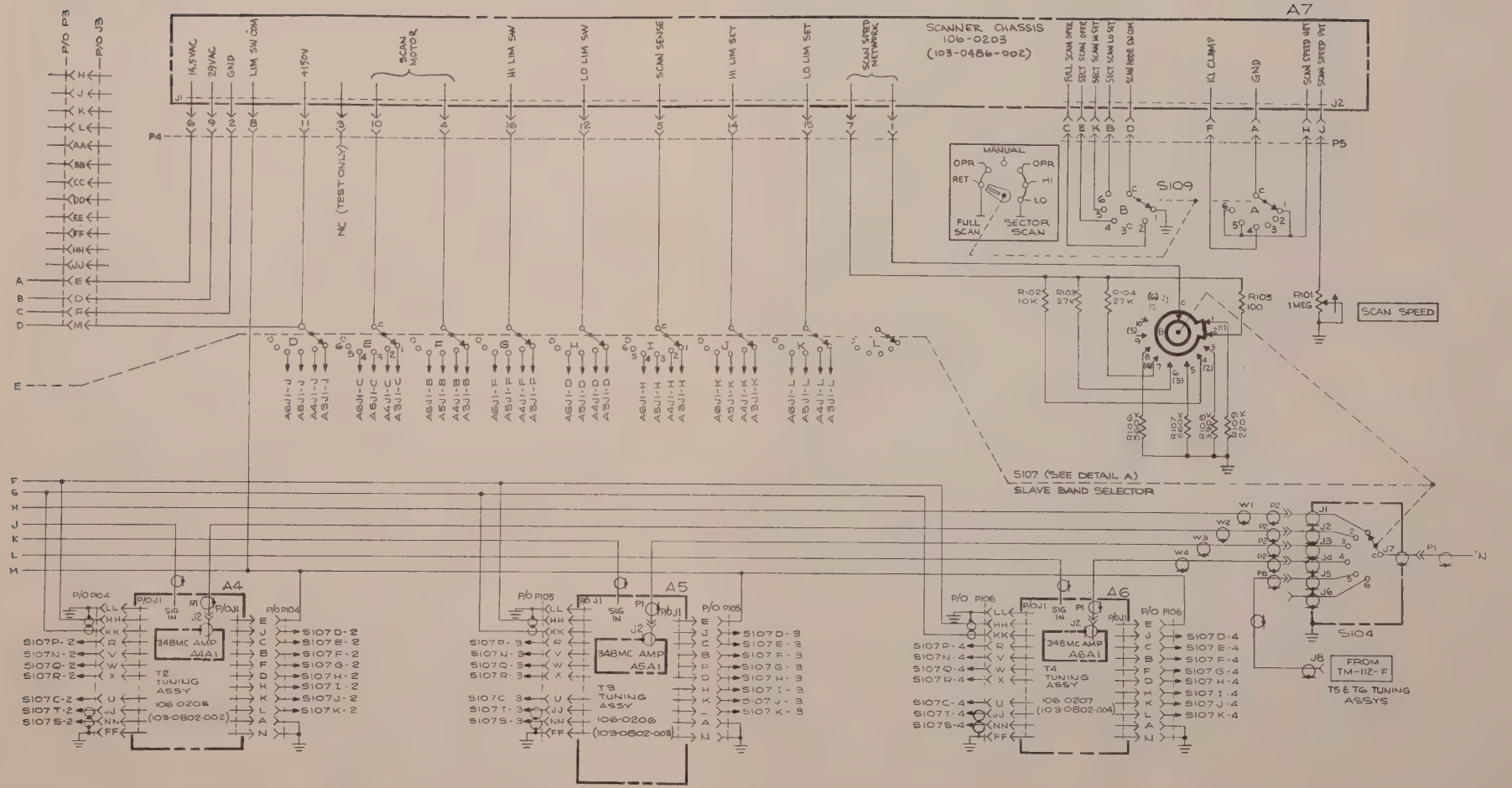


1. ALL RESISTANCES ARE IN OHMS ± 1%, 1/2W.

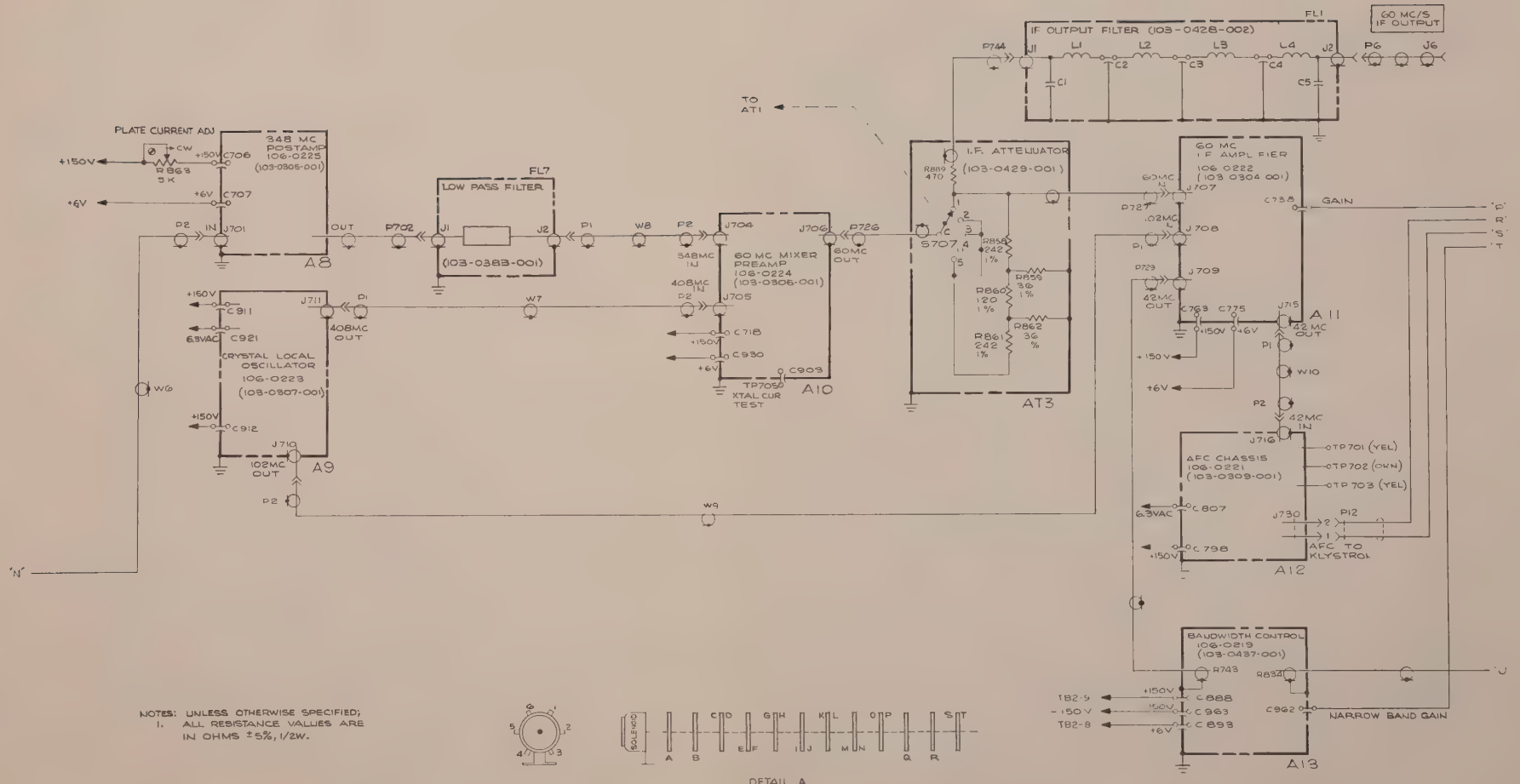
Schematic Diagram, Impulse Generator Attenuator (A16)



Schematic Diagram, 106-0201 (Sheet 1 of 4)
Interconnecting Circuitry

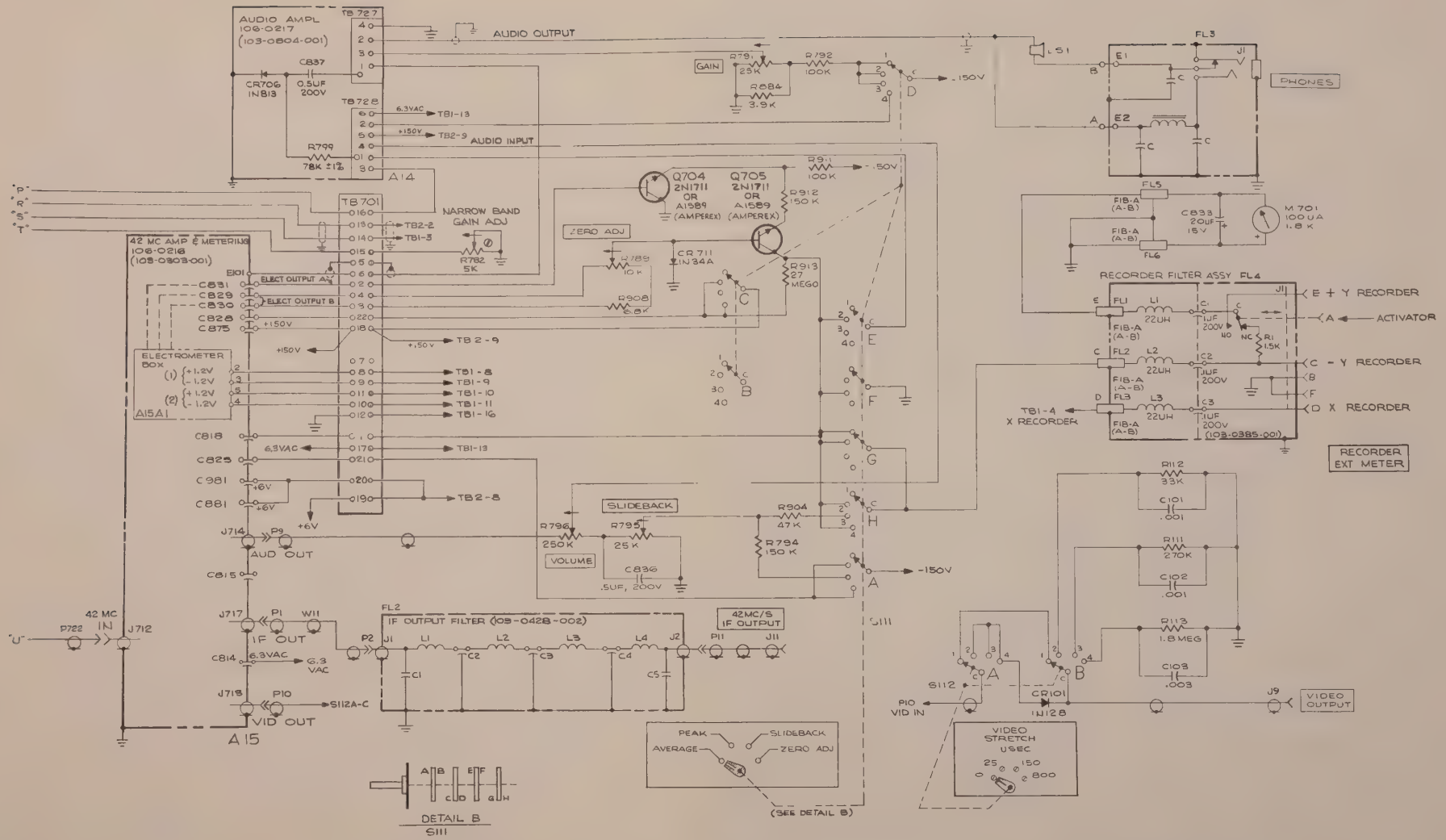


Schematic Diagram, 106-0201 (Sheet 2 of 4)
Interconnecting Circuitry

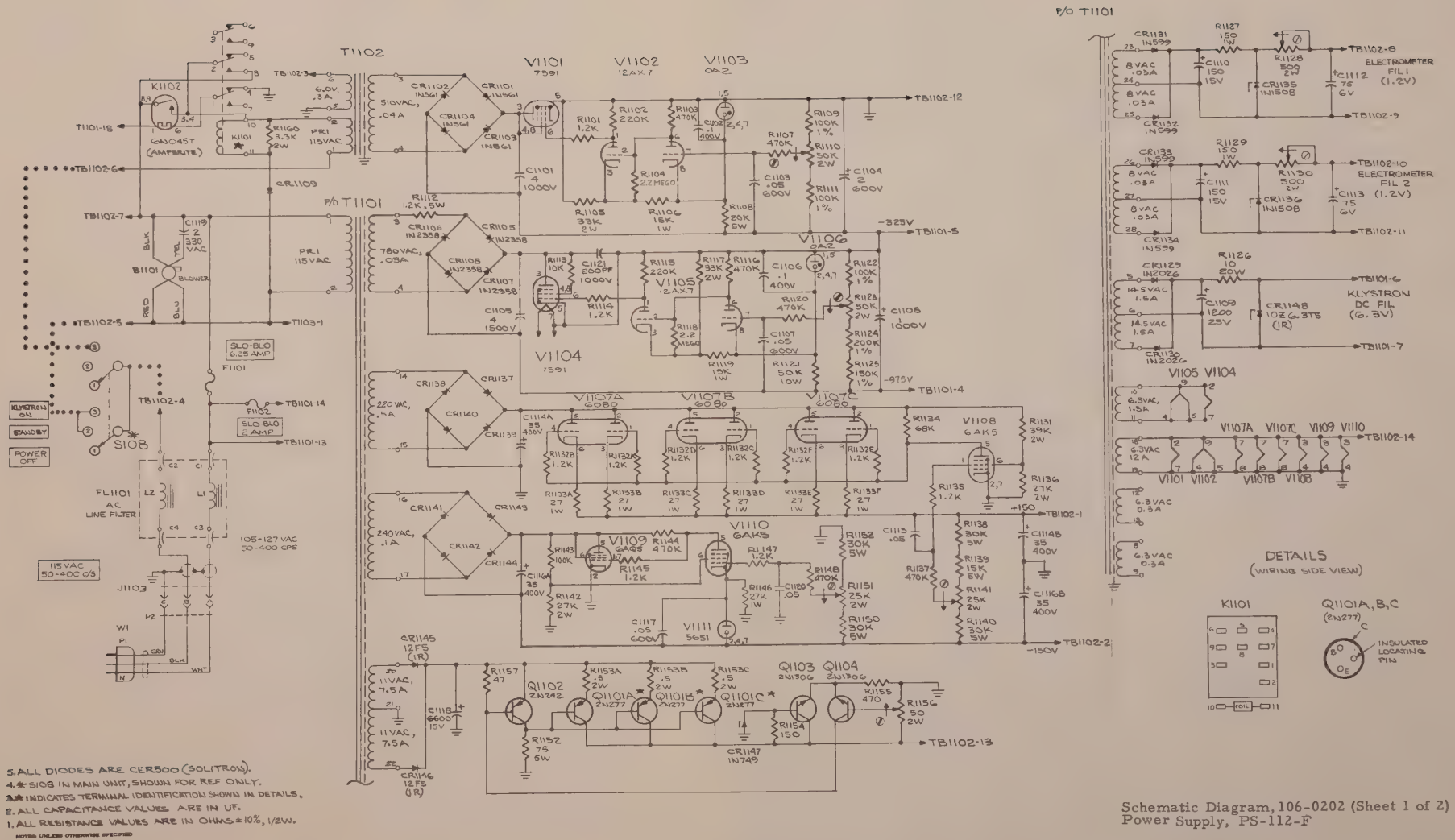


NOTES: UNLESS OTHERWISE SPECIFIED;
1. ALL RESISTANCE VALUES ARE IN OHMS ±5%, 1/2W.

Schematic Diagram, 106-0201 (Sheet 3 of 4)
Interconnecting Circuitry



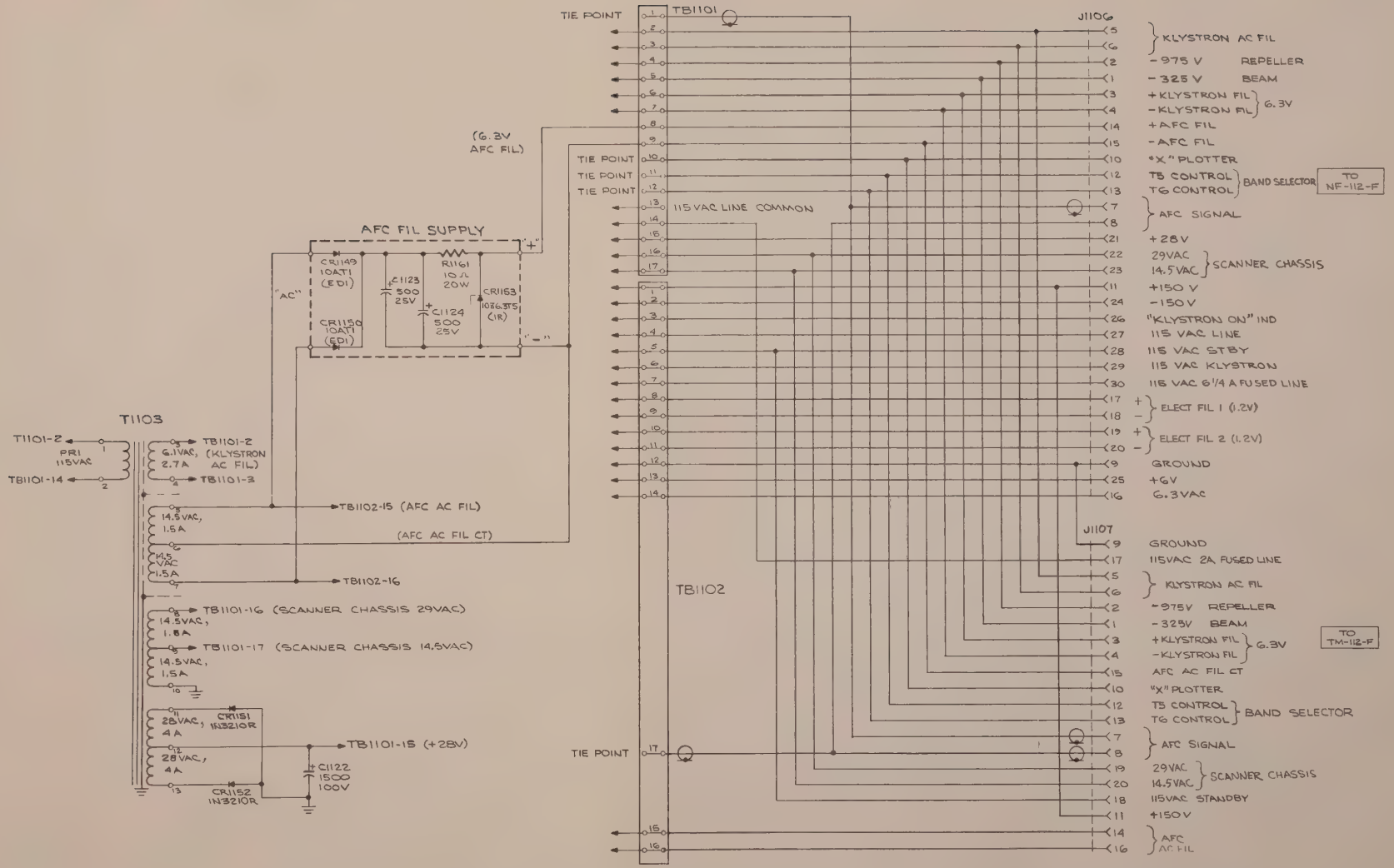
Schematic Diagram, 106-0201 (Sheet 4 of 4)
Interconnecting Circuitry



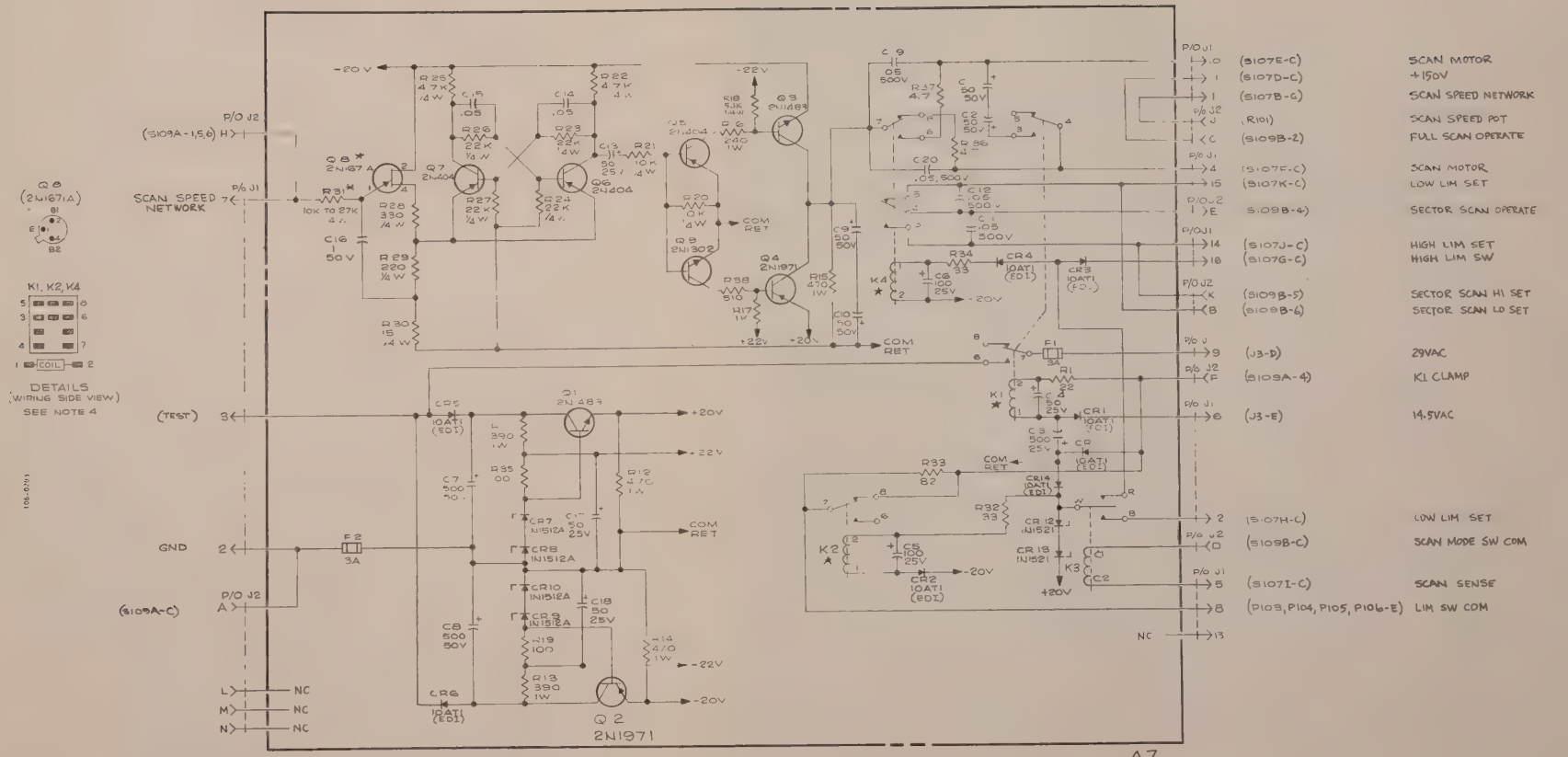
5. ALL DIODES ARE CER500 (SOLITRON).
4. * S108 IN MAIN UNIT, SHOWN FOR REF ONLY.
3. * INDICATES TERMINAL IDENTIFICATION SHOWN IN DETAILS.
2. ALL CAPACITANCE VALUES ARE IN UF.
1. ALL RESISTANCE VALUES ARE IN OHMS ±10%, 1/2W.

NOTED UNLESS OTHERWISE SPECIFIED

Schematic Diagram, 106-0202 (Sheet 1 of 2)
Power Supply, PS-112-F



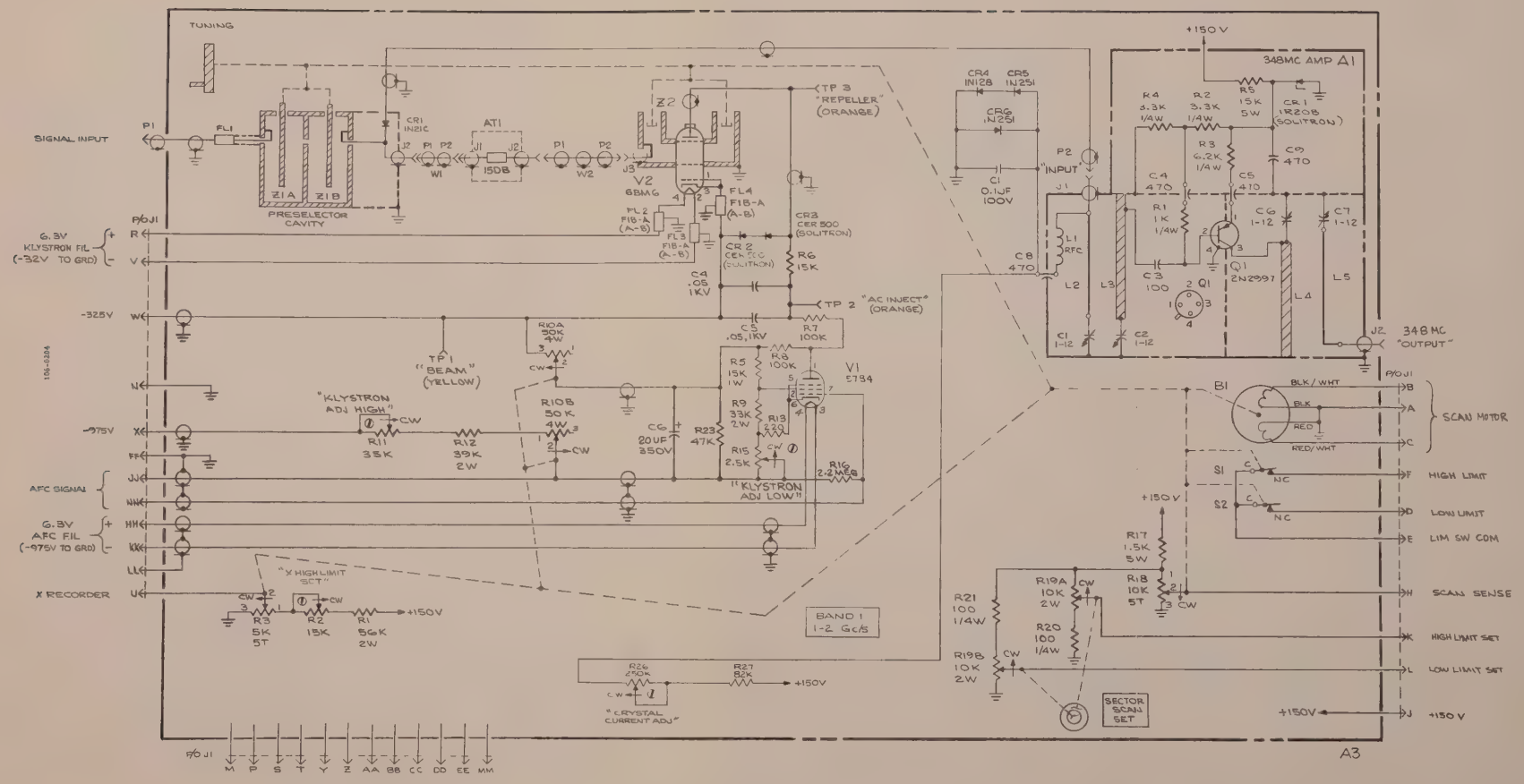
Schematic Diagram, 106-0202 (Sheet 2 of 2)
Power Supply, PS-112-F



4. ★ INDICATES TERMINAL IDENTIFICATION SHOWN ABOVE.
3. * INDICATES FACTORY SELECTED.
2. CAPACITANCE VALUES ARE IN UF.
1. RESISTANCE VALUES ARE IN OHMS ± 5%, ½ W.

NOTES UNLESS OTHERWISE SPECIFIED

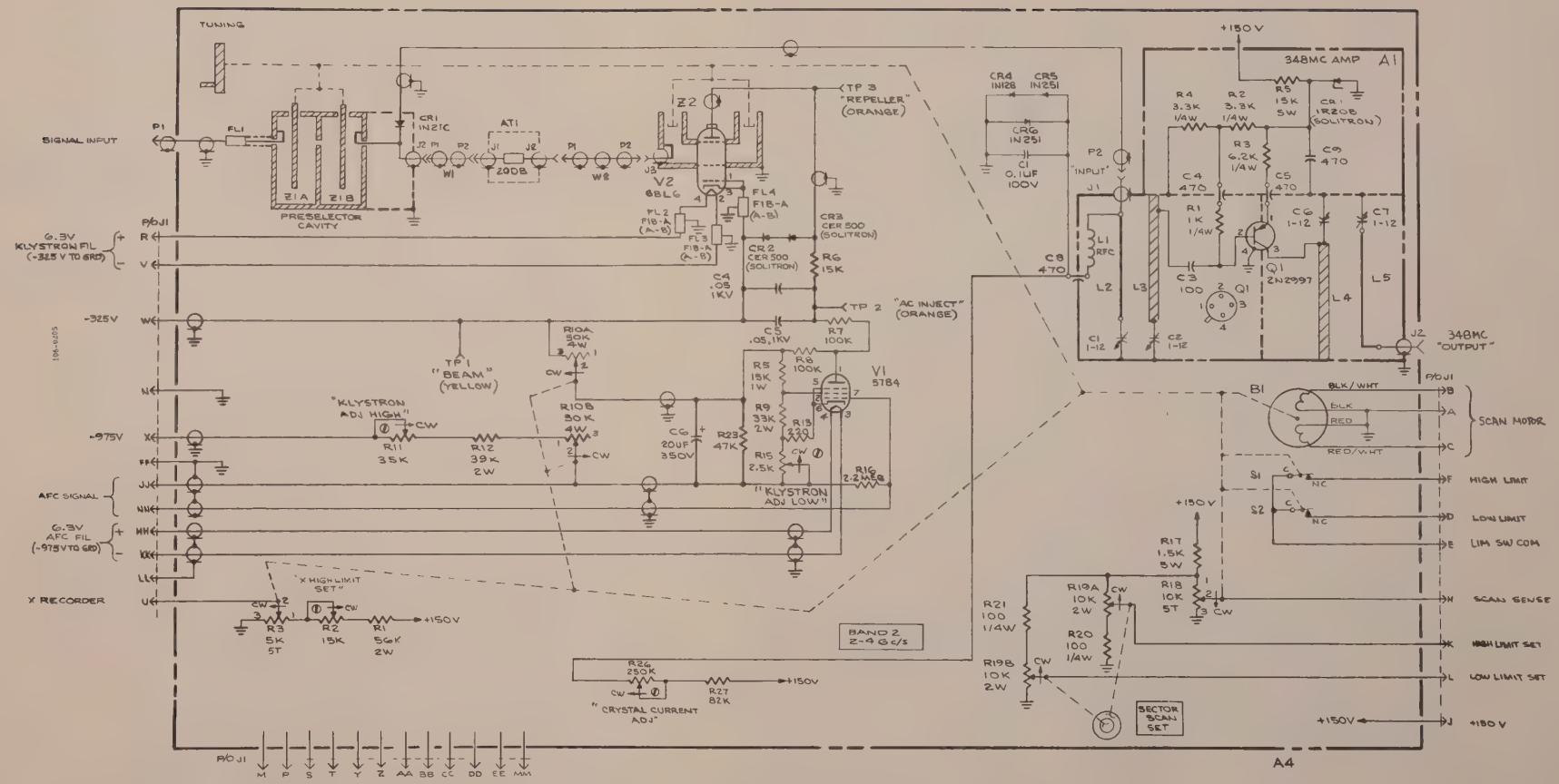
Schematic Diagram,
Scanner Chassis (A7)



2. ALL CAPACITANCE VALUES ARE IN PF.
1. ALL RESISTANCE VALUES ARE IN OHMS ±10%, 1/2W.

NOTES: UNLESS OTHERWISE SPECIFIED

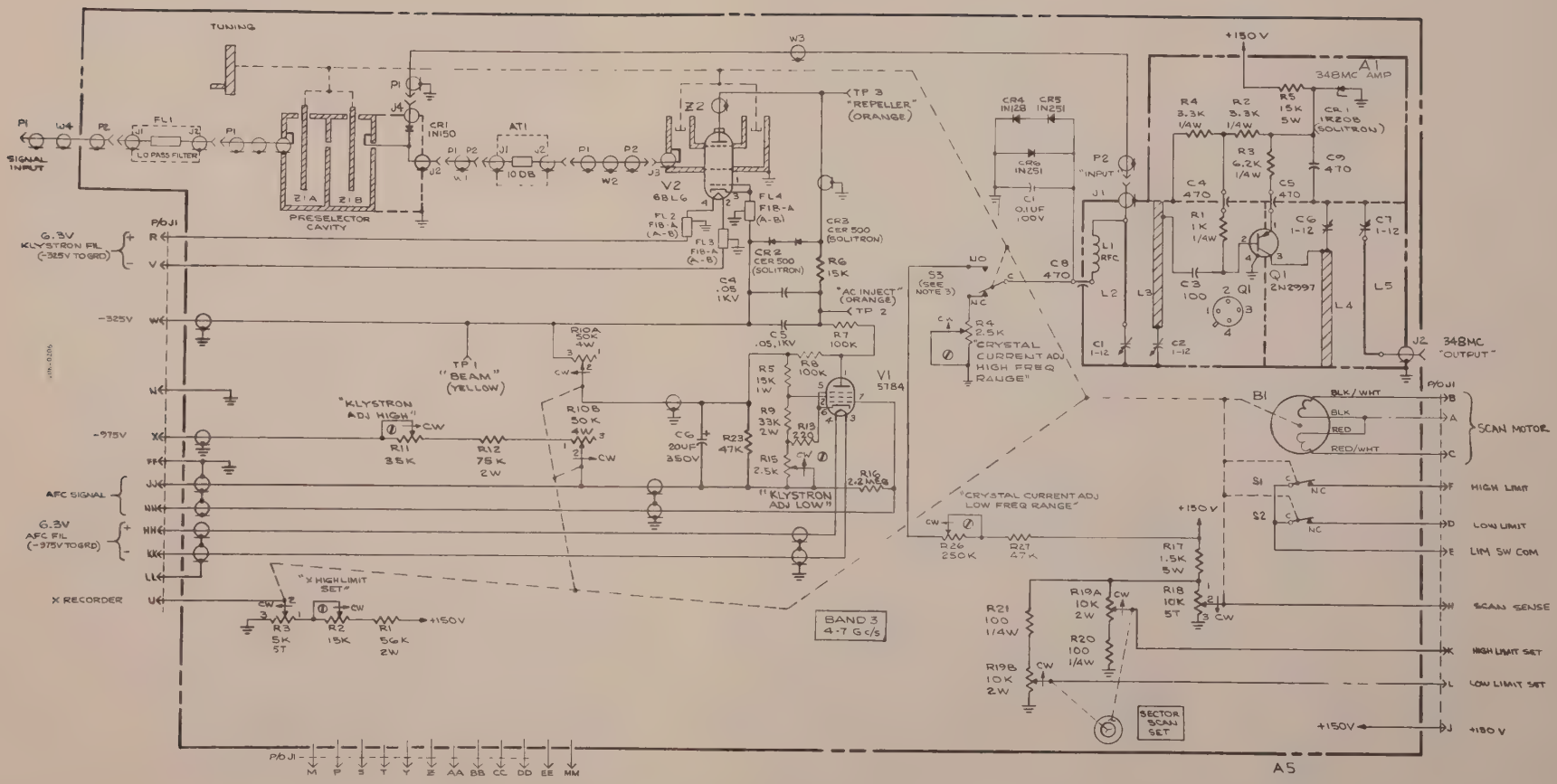
Schematic Diagram,
T1 Tuning Assembly (A3)



2. ALL CAPACITANCE VALUES ARE IN PF.
1. ALL RESISTANCE VALUES ARE IN OHMS ±10%, 1/2W.

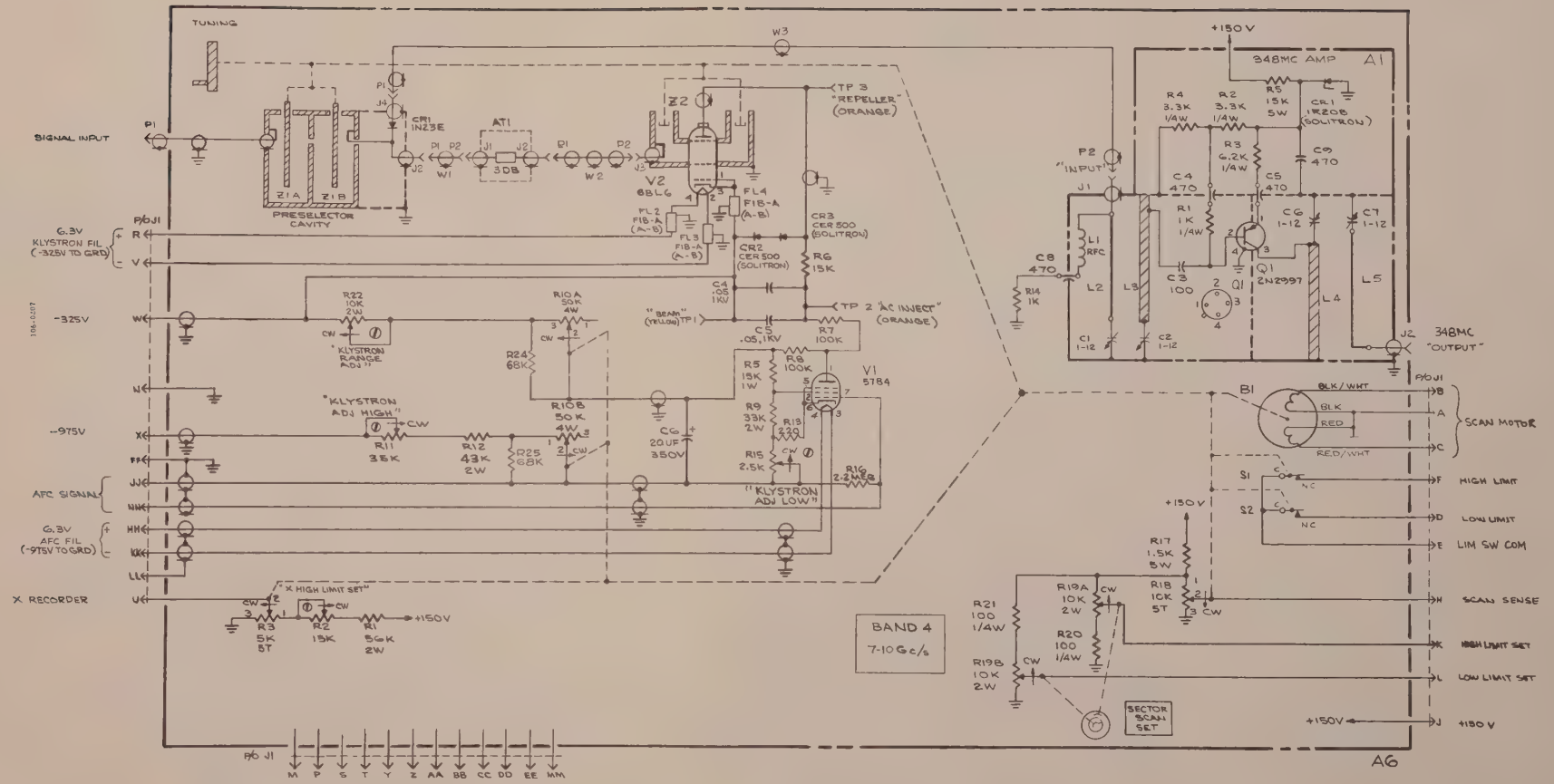
NOTES UNLESS OTHERWISE SPECIFIED

Schematic Diagram,
T2 Tuning Assembly (A4)



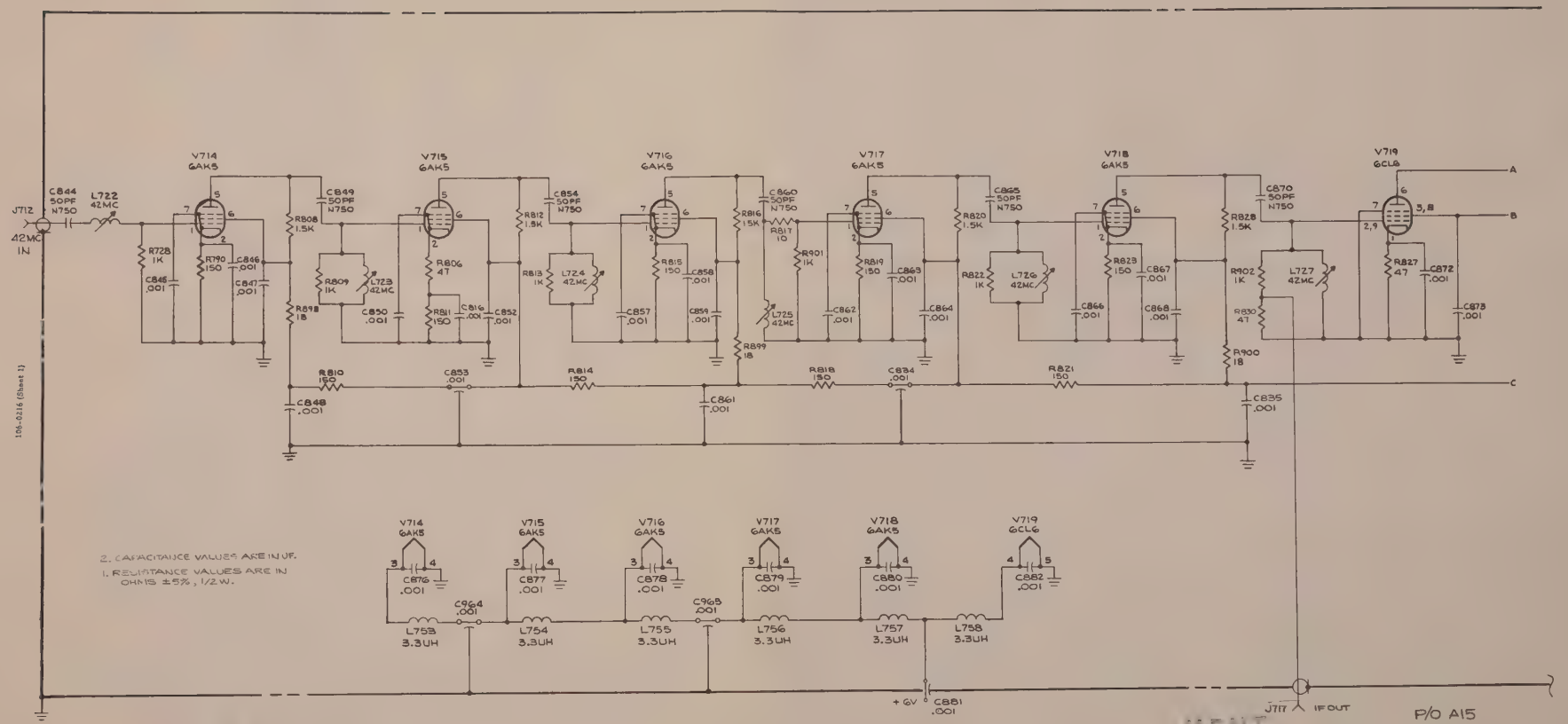
3. SWITCH S3 IN NC POSITION ABOVE 5 GC/S.
2. ALL CAPACITANCE VALUES ARE IN PF.
1. ALL RESISTANCE VALUES ARE IN OHMS ±10%, 1/2W.

Schematic Diagram,
T3 Tuning Assembly (A5)



2. ALL CAPACITANCE VALUES ARE IN PF.
1. ALL RESISTANCE VALUES ARE IN OHMS ±10%, 1/2W.

Schematic Diagram,
T4 Tuning Assembly (A6)



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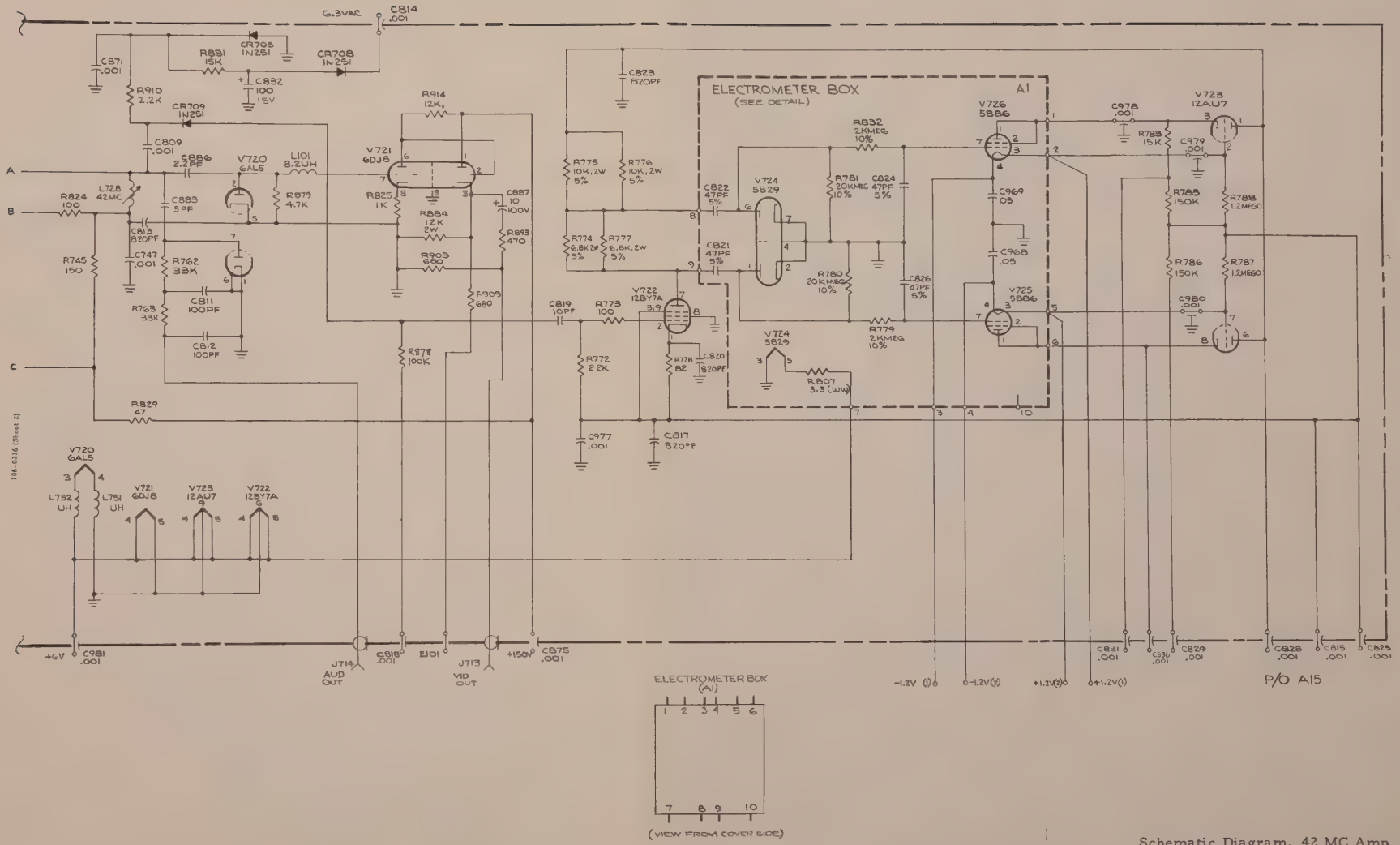
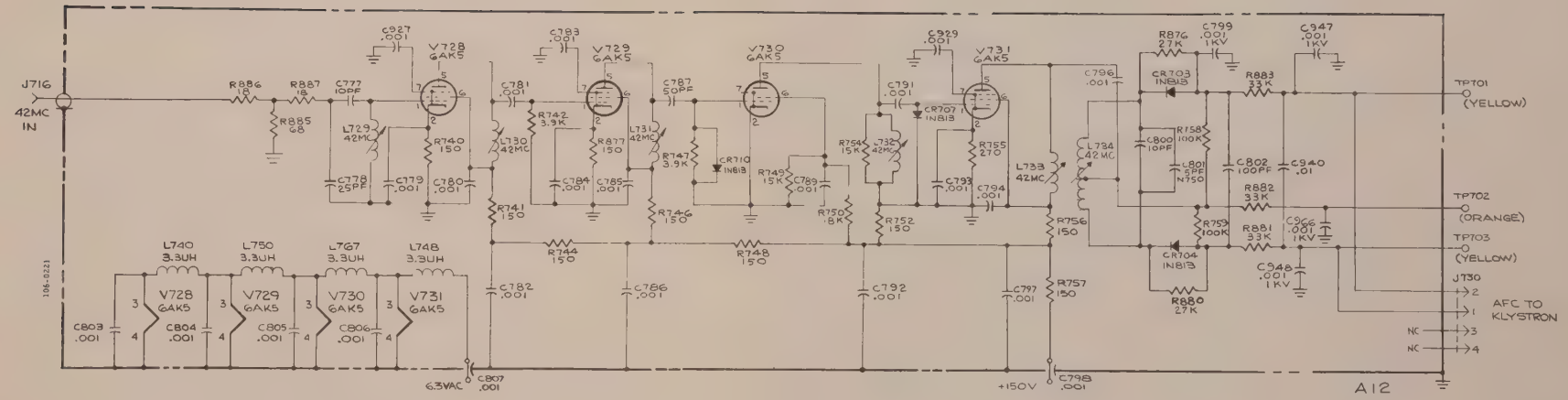
Schematic Diagram, 42 MC Amp and Metering (A15) (Sheet 1 of 2)

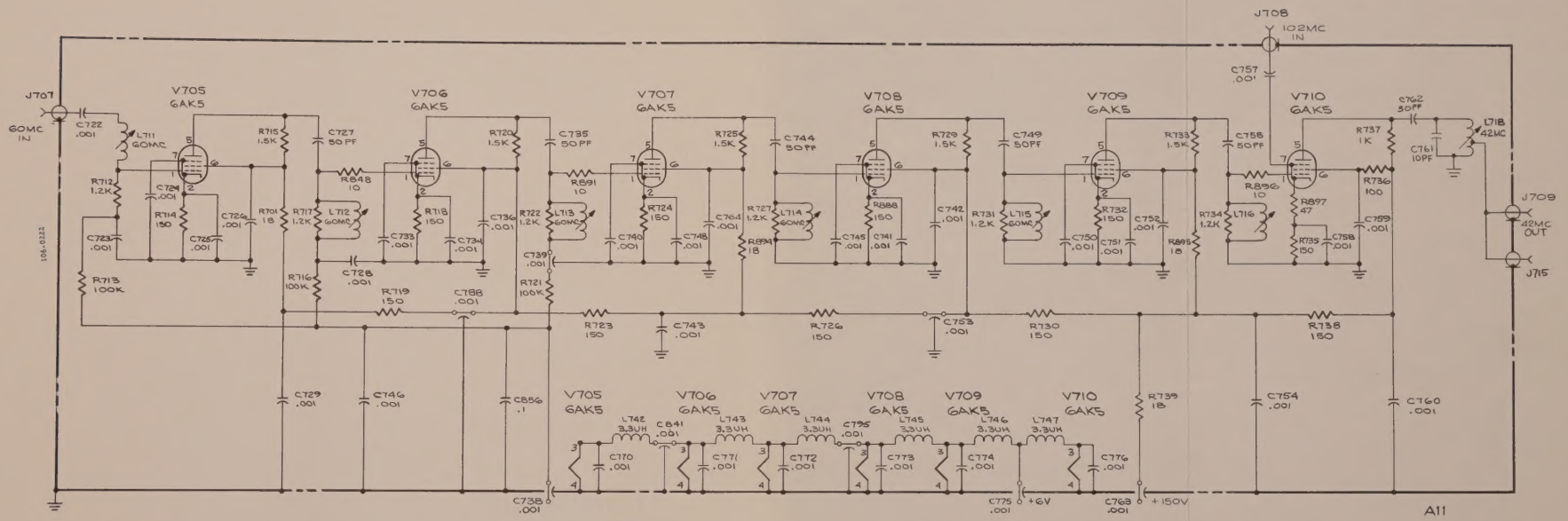


Schematic Diagram, 42 MC Amp and Metering (A15) (Sheet 2 of 2)



2 CAPACITANCE VALUES ARE IN UF.
1. RESISTANCE VALUES ARE IN OHMS ± 5%, 1/2W.

Schematic Diagram,
AFC Chassis (A12)



2. ALL CAPACITANCE VALUES ARE IN UF.
1. ALL RESISTANCE VALUES ARE IN OHMS ±5%, 1/2 W.

Schematic Diagram, 60 MC
IF Amp (A11)

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